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ABSTRACT

This document is the second of seven units developed by the Math Network Curriculum Project. Each unit, designed to be a 2-week module, is a teacher's guide which includes detailed directions along with the courseware and software needed. Teacher intervention in the non-computer activities that begin each unit is required, and the consistent use of small-group instruction makes the units usable in a standard classroom if two microcomputers are present. Continuing the exploration of Easy Speak which students began in the Input-Output Unit, the Strategies Unit emphasizes discovering, inventing, and expressing in the Easy Speak language strategies for playing the game of Nim. At the beginning of the unit, students play Nim informally and then try to guess strategies which various computer programs use. The emphasis is not on finding one best strategy, but on discovering and inventing different kinds of strategies through pattern recognition and invention. Printed copies of the code for the Guess My Strategy, Nim Speak, Nim Rater, and Calendar Game computer programs are included. Guess My Strategy is a continuation of the attempt to guess the strategies used by the computer. Nim Speak allows students to teach the computer to play Nim using some strategy. With Nim Rater (written by Jerry Lane), students try for one of three ratings; they must win three games against the computer, which is using a perfect strategy. In the Calendar program (written by Lynne Alper and Bill Finzer), a variation of Nim, students take turns choosing dates later in the year; the one who arrives at December 31 wins. It thus challenges students who know the winning strategy for Nim. The programs were developed for use on a Commodore PET Computer with at least 16K of RAM using 4.0 BASIC. (MNS)

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Strategies

Teacher's Guide

Math Network Curriculum Project

San Francisco State University

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STRATEGIES UNIT

TEACHER'S GUIDE

Math Network Curriculum Project

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OVERVIEW

The purpose of this unit is:

- To familiarize students with the notion of a strategy.

- To help students learn to discover the strategies of others and to invent their own.

- To teach students to express strategies using the language of mathematics.

This unit is designed to help students become more aware of patterns and see mathematics as a useful language. Using mathematics as a language will serve as a review of some concepts and, more importantly, will provide a sound introduction to algebra.

Generally, when one thinks of strategies for games, the focus is on winning strategies. This unit deemphasizes the notion of winning, even though the central game of the unit, NIM, has a perfect strategy (a method of playing so that one will always win.) The reason for this deemphasis is so that every student can participate in the unit and be challenged at her/his own level. By removing the pressure on students to discover the one best strategy, we hope they will feel more comfortable about trying new activities and will feel able to approach problems creatively.

As students explore at their own levels, some students will undoubtedly discover the perfect strategy as well as other mathematical relationships. We hope that while using this unit, you will feel that you don't have to know in advance everything your students are going to discover, including the perfect strategy. It is enough for you to provide creative activities for your students and greet their discoveries with enthusiasm.

HOW TO USE THIS GUIDE

Once familiar with activities in this unit, you need only refer to the Summary of Activities. To review a particular activity, a more complete description, including teaching suggestions, follows the summary of activities. We hope teachers will feel free to modify our suggestions and to use their own ideas.

We intend that most teachers using this unit will have taken a course introducing them to the units. If you have not taken such a course, you will need to read through and actually do each activity, preferably with some friends. You will need to discuss the activity's purpose and possible pitfalls as you work.

The activities in the unit are of two kinds: Total Class and Independent Computer Work. During Total Class activities, the students will work on the unit either in groups, individually, or in a whole class format. Although some of these activities may require the whole class period (approximately 50 minutes), others will require less time.

During the Independent Computer Work, small groups of students will work at each computer while the other students will work on classroom assignments from outside this unit. These computer activities are starred (*) so you will know that during these days your regular program will be integrated along with the activity from this unit. Generally, groups of two or three students will be working together at a computer. These groups will rotate during a period of several days so that all students will have the opportunity to complete the activity. Using two computers, at least four groups per class period should be able to work at the computer.

In describing the time required for an activity, we will provide the approximate number of minutes required for Total Class activities and the approximate number of days required to rotate a class of 30 students through Independent Computer Work (assuming your classroom has 2 PET computers). In total, this unit requires about 150 minutes of Total Class Time and 7 days of Independent Computer time. The activities can be spread out over a period of time.

The activities in this unit are designed to be used in the sequence given. There are, however, optional activities for all or some of your students included at the end of this guide. Some of the optional activities can be interspersed with the basic activities. Appropriate places for inclusion are presented in the optional activity description.

SUMMARY OF ACTIVITIES

Prerequisite: Input-Output Unit

Total Time Required:
Total class - 150 minutes
***Independent Computer - 7 days**

1. **BONE GAME**
   Format - Groups of two, four, and whole class.
   Time - 25 minutes
   Materials Needed - 2 small objects per pair of students (crayon, eraser, paper clip, etc.)

2. **BASIC NIM**
   A. **Introduction**
      Format - Whole Class
      Time - 10 minutes
      Materials Needed - 12 large objects visible from the back of the classroom (books, blocks, etc.) or a chalkboard.
   B. **Exploration**
      Format - Groups of 2
      Time - about 20 minutes
      Materials Needed - 12 small objects per pair (wooden cubes, toothpicks, crayons, etc.)

3. **GUESS MY STRATEGY**
   A. **Introduction**
      Format - Whole Class
      Time - 15 minutes
      Materials Needed - computer, Guess My Strategy Program, 1 Guess My Strategy Worksheet for each student, chalkboard.

   ***B. Play**
      Format - Groups of threes
      Time - 3 days (20 minutes per group)
      Materials Needed - 1 computer with Guess My Strategy Program per group, 3 Guess My Strategy Worksheets per student.

4. **NIM SPEAK**
   A. **Introduction**
      Format - Whole Class
      Time - 20 minutes
      Materials Needed - 1 Computer Nim Speak Program, 1 Nim Speak Worksheet per student, 1 Easy Speak Summary per student, students' filled-in Guess My Strategy Worksheets, 12 small objects per pair of students (cubes, toothpicks, paper clips, etc.)

   B. **Preparation**
      Format - Groups of two
      Time - 30 minutes

Materials Needed - 3 to 4 Nim Speak Worksheets per pair, 1 Easy Speak Summary per student.

*C. **Use**

Format - Groups of twos
Time - 4 days (20 minutes per group)
Materials Needed - 1 computer with Nim Speak Program per pair, filled-in Nim Speak Worksheets, 1 Easy Speak Summary per student.

OPTIONAL ACTIVITIES

*A. **NIM RATER**

Format - Individuals or groups
Time - Variable (15 minutes per group)
Materials Needed - 1 computer with Nim Rater Program and 4 Nim Rater Recording Sheets per group.
Prerequisite - BASIC NIM - Exploration

*B. **CALENDAR GAME**

Format - Individuals or groups of two
Time - Variable (about 15 minutes per group)
Materials Needed - 1 computer with Calendar Game Program per group.
Prerequisite - BASIC NIM - Exploration

* indicates Individual Computer work.

MATERIALS FOR THIS UNIT

Materials

2 small objects per pair of students (crayon, eraser, paper clip, etc.)
12 large objects (books, blocks, etc.)
12 small objects per pair of students (wooden cubes, toothpicks, crayons, etc.)
1 Easy Speak Summary for each student
2 PET computers

Worksheets

Guess My Strategy - 4 per student
Nim Speak - 5 per student
Nim Rater Recording Sheet (optional) - 4 per group

PET Computer Programs

Guess My Strategy
Nim Speak
Nim Rater (optional)
Network Nim Speak (optional)
Calendar Game (optional)

BONE GAME

Format
Groups of two, four, and Whole Class

Time
25 minutes

Materials Needed
2 small objects per pair of students (crayon, eraser, paper clip, etc.)

The Game

The bone game has many variations and is played by many Native American tribes. Two people or teams play with two small objects (the bones). One player hides one bone in each fist or both bones in the same fist. The other player guesses whether the bones are in the right fist, the left fist, or split between the two. A player gets a point for a correct guess, and players exchange roles.

Background

This activity introduces the Strategies unit, whose objective is:

a. to have students guess about strategies other people and computer programs use, and

b. to have students invent their own strategies.

Therefore, this introduction provides students with a common experience that involves (usually unconsciously) a strategy. All of the students playing will use a strategy in hiding the objects (such as, "They'll never expect me to do the same thing twice, so I'll do the same thing twice") and in guessing where the other player has hid the objects (such as, "The other player is squeezing the left fist harder than the right, so they both are in the left fist").

After playing the game as individuals, students will play in teams of two. Thus, teammates will naturally discuss strategies with each other. The class discussion following the play of the game will help students:

a. to understand what strategies are;

b. to start expressing their strategies in words (later in the unit they will express strategies in symbols), and

c. to gain confidence in their ability to invent strategies.

Purpose

- To provide students with a common experience that involves a strategy.

- To start students thinking about strategies.

Teacher Preparation None

Activity

Explain the game to the students. You probably want to demonstrate the game by hiding two bones in your fists. Have the students play the game ten times with a partner. (There can be groups of three also.)

Pair each team with another team and play ten more times. Encourage team member discussions before hiding or guessing.

With the whole class, share and discuss strategies used in the bone game. Be sure to deal with both hiding and guessing strategies. Since everyone should have something to say, this should be a good opportunity to encourage less confident students to speak. Accept all suggestions. Discussion might lead to strategy changes resulting from what the other group did before: was any record-keeping (informal or formal) used; how were group decisions made; was it easier working with a partner, etc.

Tell students that the rest of the unit will deal with strategies.

BASIC NIM

Introduction

Format
Whole Class

Time
10 minutes

Materials needed
12 large objects visible from the back of the classroom (books, blocks, etc.) or chalkboard

The Game

Nim is a very old game which has many versions. We call Basic Nim the game where two players:

a. start with 12 objects;

b. take turns taking 1, 2, or 3 objects on a turn, and

c. the player taking the last object wins.

Later versions of Nim used in the unit will start with a number of objects different from 12, and on a turn the maximum number of objects to take will differ from 3.

Background

Nim is a game that almost everyone enjoys, except when too much pressure is put on them to win. Thus, this unit uses Nim as a vehicle for students to think about strategies. It never requires students to know the best strategy, ie. the one that always wins. Some students will discover this best winning strategy, but you do not need to know it to use this unit. The nice thing about the game is that it encourages students to think of strategies whether or not they find the right one.

Purpose

- To teach students the rules of Basic Nim.
- To interest students in the game of Nim.

Teacher Preparation

Gather 12 large objects. Or you may use the chalkboard instead.

Activity

Place the 12 objects in front of the class (along the chalkboard or on your desk), or put 12 marks on the chalkboard.

Tell the students they will take turns taking 1, 2, or 3 objects, and the winner is the one who takes the last one.

Let the class decide whether they want to go first or second in playing against you.

Play the game with the class either randomly or trying to win.

Play with the class again or let two sides of the room play or let two students play in front of the class.

Continue playing until everyone knows the rules and the class is interested in the game.

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BASIC NIM

Exploration

Purpose

- To provide students with a concrete experience so that they can develop and refine some strategy for Nim.

Format
Groups of two

Time
about 20 minutes

Materials Needed
12 small objects per pair (wooden cubes, toothpicks, crayons, etc.)

Teacher Preparation

Gather 12 small objects for each pair of students.

Activity

Remind students of the rules for Basic Nim.

Set them up in groups of four, help them find partners and make sure each pair has 12 small objects.

Tell students they are to play for 10 minutes to get a feel for the game, and then they should switch partners.

After students switch partners, tell them to try to devise some good strategies for winning with their partners. (They can work for more than 10 minutes if interest is high.)

You might want to walk around and eavesdrop to see what kind of strategies your students come up with.

If the teacher knows the winning strategy, any group could be given the challenge to beat the teacher. The teacher can then select any group member or different group members to play against. This should encourage group cooperation and careful explanation to each other about strategies.

GUESS MY STRATEGY

Introduction

Format
Whole Class

Time
15 minutes

Materials Needed
Computer
Guess My Strategy Program
1 Guess My Strategy Worksheet for each student
chalkboard

Background

The "Guess My Strategy" computer program offers the student the opportunity to get to know six different Nim players or Nim-playing programs. The Nim games used in this program are variations on Basic Nim where the number to start with and the maximum to take are varied. Students have three options:

A. Playing against my strategy;

B. Imitate my strategy; or

C. Gamble on two strategies.

The purpose of playing with a program (Option A) is to discover the program's strategy, not to beat the program. This may be hard for your students to understand, and you will probably find yourself repeating the purpose of this activity several times.

For your information (but for your students to discover on their own), the strategies of the programs are given below. **Don't read the six descriptions below until you have discovered some of the programs' strategies yourself, or you won't get a feel for the activity.**

1. One-Track goes first if given a choice and always takes the maximum allowed until there are less than the maximum left.

2. Very Cool goes second if given a choice and always takes one until he can win in one more.

3. Obsessed! goes first if given a choice and first takes 1, then takes 2, and then 1, and then 2, etc.

4. Zerox refuses to go first and always does exactly what the other player did on the last move.

5. La Diabla plays perfectly unless she is forced into a losing position by being required to go first when she wouldn't want to or by the other player's first move. In those cases she plays randomly (hoping the other player will blow it).

6. Coach plays just like La Diable but "coaches" the other player and lets them take back their last move if it isn't the best thing to do. (This is a good program to play when trying to learn the winning strategy.)

Once a student has discovered a program's strategy, she/he can try to imitate it (Option B). If she/he does not play as that program would, the program appears on the screen to say it wouldn't have played that way.

A challenging activity is to try to guess which of two programs is likely to win. That involves the choice: Option C. Gamble on two programs.

In the activity described below, students will simply learn how to operate Option A: Play with a program. In the next activity they will try to learn the strategy of several program through this Option (students may work with other options if time permits).

Purpose

- To help students refine ideas about strategies.
- To provide practice in guessing strategies.
- To teach students to use the Guess My Strategies program.

Teacher Preparation

Play with Zerox and either Obsessed!, One-Track, or Very Cool before class on Option A of the Guess My Strategy program. Try to figure out their strategies. (If you don't, your class probably will.)

Before class, put a PET computer in front of the class so most of the students can see the screen.

Load the Guess My Strategy program into the computer (takes about 5 minutes to load).

Distribute GUESS MY STRATEGY worksheets to all students.

Activity

Ask students what strategies they found for Basic Nim. Don't judge students' ideas yourself (except perhaps for saying, "That's interesting"), but ask other students what they think of the strategies and if they can extend them. Some students may try to describe the perfect strategy. Help them say exactly what they mean, but don't expect everyone in the class to follow the discussion.

Tell them that the PET has 6 different programs inside, all with different personalities and all with different strategies. The programs all play Nim with a certain number of matches and a certain maximum to take. There won't usually be 12 matches to start or 3 matches as the maximum to take. Some of the programs play quite well, and others have very poor strategies that won't win very often. Tell them their job is not to beat these programs; rather, it is to discover their strategies so that at any point they'll know exactly how many matches a program will take. This may be hard for students to understand since they are used to playing games to win, not to understand the other player. So you may have to constantly remind them of the object of the activity.

Run the program. It asks for your name. You can type in "Class" or any other name your class wants. When they play, they can select a group name.

The program then gives 3 choices. For this activity, they will pick **A**, "Playing against my strategy." (If their group finishes figuring out the strategies of two programs, they can try Option **B**. Press **A** and type 4 for Zerox. Tell the students that later, when they play, they should select One-Track, Obsessed, or Very Cool. Have them circle "Zerox" on line 1 of the work sheet for this activity.

Point out to students that the "START WITH" number won't always be 12 and the "MAX TO BURN" won't always be 3. Have them write the two numbers they got for Game 1 on the back of their sheet.

The computer now asks if you want to choose who goes first. Since you want to find out (line 3 of Worksheet) how Zerox feels about going first, it's best to let it choose, so type "N".

Now play the game with Zerox. Emphasize to the class that you aren't trying to win. You want to find Zerox's strategy.

When the computer asks if you want to see the table, type "Y" and copy it on the board. Have students copy it on the back of their sheets. Tell them they need to record the games so they can find the pattern of Zerox's strategy.

Have the students raise their hand if they think they know Zerox's strategy (Don't let them give the answer away). Play another game or two until almost everyone sees Zerox's strategy. You might have students give hints if everyone doesn't see that Zerox is just a copy cat.

Now fill in the Worksheet together. If you have time, about 3 minutes, you might want to try B, "Imitate my strategy" and imitate Zerox.

GUESS MY STRATEGY WORKSHEET

Be sure to tell the PET you want (A), Playing Against My Strategy. You can choose One-Track, Obsessed, or Very Cool.

Play as long as necessary with the same program until you think you know its strategy.

1. Circle the name of the program you select:

   A. One-Track B. Obsessed C. Very Cool D. Xerox

2. Describe your program's strategy.

3. How does your program feel about going first?

4. Do you think your program is a good player? Why?

See if you can imitate your program!

Turn page over to record games.

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Game 1

Start With:_____

Max to Burn:_____

If your program had a choice, did it choose to go FIRST or SECOND (circle one)?

Player **Burnt** **No.Left**

Game 2

Start With:_____

Max to Burn:_____

If your program had a choice, did it choose to go FIRST or SECOND (circle one)?

Player **Burnt** **No.Left**

Game 3

Start With:

Max to Burn:_____

If your program had a choice, did it choose to go FIRST or SECOND (circle one)?

Player **Burnt** **No.Left**

Game 4

Start With:

Max to Burn:_____

If your program had a choice, did it choose to go FIRST or SECOND (circle one)?

Player **Burnt** **No.Left**

GUESS MY STRATEGY

Play

Format
Groups of three

Time
3 days (20 min. per group)

Materials Needed
1 computer with Guess My Strategy Program per group
3 Guess My Strategy Worksheets per student

Background

In this activity students will work on the Guess My Strategy computer program Option A. By observing how a particular program (such as One-Track) plays in various situations, they should be able to determine its pattern and to predict what it will do in other situations. Once students can predict a program's behavior, they should try to describe it in English on the worksheet. Later they will be asked to describe a program's behavior in symbols using the Nim Speak program. Thus, the step of describing a program's behavior in English is a critical one, and you will need to check the students' worksheets to see that they have done a careful job of their description. For example, they should not, say, describe Very Cool as always taking one, since he takes more than one when he can win in one move (i.e., when only the maximum to take or less is left.) By helping students learn to be precise at this English language stage of description, you will be making it easier for them to work with symbols.

Purpose

- To give students practice in guessing strategies and in expressing their findings.

Teacher Preparation

It will take about 3 days for the trios of students to rotate through the activity on the computers. Students not using the computers will need to be working on another activity.

Help students form groups of three (or some twos).

Run off enough copies of the Guess My Strategy Worksheet so that each student has 3 copies.

Load the Guess My Strategy program into the computers before class.

Activity

At the beginning of class, assign groups to the computer. Each group will need about 20 minutes.

Give each group a start and stop time to facilitate the changeover of groups.

Review the directions for the program, if necessary.

Each group should:

1. try to discover the strategy for at least two of the programs on the worksheet, and:

2. if time permits, they should try to imitate one program by selecting Option B.

Remind students to fill in both sides of their worksheet. (Some groups may need to play fewer games than others to discover the strategy.)

The students on the computers should not need much supervision. However, you should check that their descriptions of the program's behavior really fit the evidence (i.e., that their descriptions match the recorded moves on the reverse side of the worksheet).

Worksheets should be kept in their folders since they will use the completed sheets later.

NIM SPEAK

Introduction

Format
Whole Class

Time
20 minutes

Materials Needed
- 1 computer
- Nim Speak Program
- 1 Nim Speak Worksheet per student
- 1 Easy Speak Summary per student
- students' filled-in Guess My Strategy Worksheets
- 12 small objects per pair of students (cubes, toothpicks, paper clips, etc.)

Background

The Nim Speak program allows students to teach the computer to play Nim using some strategy. Students will use the Easy Speak language which they learned in the Input-Output Unit. The purpose of expressing a strategy in Easy Speak is to give students a chance to see mathematics as a language and to feel the power of that language.

Algebra is the traditional mathematics language. It is used to communicate between humans when one is expressing a law such as $E = MC^2$. Although students are often interested in discovering laws, they are less interested in expressing them in symbols.

Algebra is also used to communicate with ourselves when we are solving real world problems (or algebra word problems). We start with a problem and express it in algebraic symbols. Then we manipulate the symbols to get an answer to our original problem. This process is an exciting one and one which students will meet later in their education. The difficult part of that process is to express real world problems in the language of algebra.

We believe that practice in expressing Nim strategies in the Easy Speak language will help students in their later work with algebra. First, they will get used to expressing ideas using mathematical symbols and variables. Secondly, they should be motivated to use this language. Its use will enable them to have control over the computer (i.e., it will play Nim as they wish it to). Thus, using Nim Speak should be an exciting and beneficial activity.

When you begin the Nim Speak program, you will be presented with several options. Option A will allow you to program the PET using Nim Speak. There is the possibility of using three variables in programming your strategy. They are **START**, **MAX**, and **LEFT**. **START** can represent the number of matches to start with and **MAX** can represent the maximum number a player can take. If used in the starting conditions, they allow the computer to randomly select the starting and maximum numbers each time the strategy is played. **LEFT** represents the number of matches left to be taken. Both **LEFT** and **MAX** can be used as a part of the strategy.

example:

CONDITION: LEFT<MAX
TAKE: LEFT

Since most students may not be ready for so much at once, we recommend that students be restricted to the variable **LEFT** and start with 12 and a maximum to take of 3. As they progress, you could introduce the other variables to the students as appropriate.

You might wonder why we used words (or parts of words) for variables instead of letters as one usually does in algebra. One reason is that words make more sense and are less abstract. Another reason is that words are often used in computer programming so programmers can remember what the symbols stand for when they come back to a program after some time.

Purpose

Students will learn to use the Nim Speak program.

Teacher Preparation

The day before, try Nim Speak on your own or with a friend. Try to make the computer play like One-Track or Very Cool. (You won't be able to do this with Obsessed or Zerox since the Nim Speak language doesn't allow reference to the previous move.)

Run off copies of the Nim Speak Sheet so each student has a copy.

Before class, load the Nim Speak program into a computer and place the computer so that all may see the screen.

Activity

Make sure each student has a Nim Speak Sheet, an Easy Speak Summary, and their completed Guess My Strategy Worksheets. There should be 12 small objects per each pair of students.

Review with the class the strategies for One-Track, Obsessed!, and Very Cool. Each student should have worked with at least two of these programs. Try to get consensus as to whether each program wants to go first or second and how it plays. If students disagree, encourage them to settle their differences by using the tables they recorded. If there is still disagreement, leave the matter as an open question. (Giving them a definitive answer would make them more dependent on you and possibly discourage their own exploration.)

Tell the students the Nim Speak program will allow them to teach the computer a Nim Strategy. Have the class pick one of the two strategies that they feel they know best (Very Cool or One Track).

Have the class take out the Nim Speak Sheet. Since the whole class is teaching the computer, they will write "Class" for Programmer. Later they will fill in their own name.

As mentioned above, the computer asks what they want for the starting number. They should tell the computer to start with 12 matches. The students write 12 after line 1 on the sheet. Similarly, they are asked for the maximum to take and should choose 3 for that number. The students should write 3 after Line 2.

Now the computer needs to know when to go first. The students should try to find an expression to tell the computer when to go first. They will probably choose "Always" (it means in every case) or "Never" (it means in no case). There are other choices they could make such as If 1=1 (instead of "Always") or If 1+2=5 (instead of "Never"). But let them choose. If they make a mistake, they will learn about it later. The point here is that the machine needs to have a condition to tell it whether it will go first or not. Here is a good time to draw from the class a collection of possible conditions for going first.

Now the computer will be asking for a set of conditions that will make up a strategy for playing. It will alternatively ask **CONDITION:** (which will require a condition) followed by **TAKE:** (which tells it how many to take under that condition). Students will be able to use any of the Easy Speak words and

the variable LEFT. Should any of the conditions be incorrectly phrased or too complex, the program will say I'M SORRY BUT I DON'T UNDERSTAND THAT or THAT'S TOO COMPLICATED FOR ME, and the student can try again.

Once the program has been entered (after typing "Shift" and "&"), the computer will give you several additional choices: Select E to play against the strategy. The computer will try to do as it was told. When it comes upon a conflict, it will tell which line(s) are giving it trouble and will stop playing. Pressing RETURN will bring back the NIMSPEAK CHOICES. If a conflict has occured, typing F (EDIT MY STRATEGY) will display your program. In this situation, typing return will accept the line as it is. Otherwise, you can use the delete key to erase the existing statement and retype the statement. The delete using "Shift" and "@" will delete the entire condition and renumber the remaining statements.

Have the students choose a partner and write a few conditions in English which they think will get the computer to play the strategy they want. Then have them play Nim using the 12 small objects with one player following the English conditions. Lastly, let the students translate the English into Easy Speak. Here are a few strategies they might write:

Sample Program 1

START WITH: 12

MAX TO TAKE: 3

START CONDITION: ALWAYS

1. CONDITION: If ODD (LEFT)

   TAKE: 1

2. CONDITION: If EVEN (LEFT)

   TAKE: 2

Sample Program 2

START WITH: 12

```
MAX TO TAKE:  3

START CONDITION:  NEVER

1.  CONDITION:  LEFT = 12

        TAKE:  2

2.  CONDITION:  LEFT = 11

        TAKE:  1

3.  CONDITION:  LEFT = 10

        TAKE:  2

4.  CONDITION:  LEFT = 9

        TAKE:  1

        .
        .
        .
    etc.
```

Sample Program 3

```
START WITH:  12

MAX TO TAKE:  3

START CONDITION:  LEFT = 12

1.  CONDITION:  LEFT > 3

        TAKE:  1

2.  CONDITION:  (LEFT < 3) OR (LEFT = 3)

        TAKE:  LEFT
```

Nim Speak Sheet

Programmer:

START WITH:

MAX TO TAKE:

START CONDITION:

1. CONDITION:

   TAKE:

2. CONDITION:

   TAKE:

3. CONDITION:

   TAKE:

4. CONDITION:

   TAKE:

5. CONDITION:

   TAKE:

6. CONDITION:

   TAKE:

7. CONDITION:

   TAKE:

8. CONDITION:

   TAKE:

9. CONDITION:

   TAKE:

10. CONDITION:

    TAKE:

EASY SPEAK SUMMARY

+	addition	=	equals
-	subtraction	<	less than
*	multiplication	>	greater than
/	division	<=	less than or equal to
↑	exponentiation	>=	greater than or equal to
		<>	not equal to

ODD

ODD (INPUT)

EVEN

EVEN (INPUT)

ALWAYS

Is always true.

NEVER

Is never true.

FACT

FACT(5,INPUT)
Will be true if 5 is a factor of the input.

NOT

NOT(INPUT < 10)
Change the truth value of the statement.

AND

(5,INPUT) AND (EVEN(INPUT))

OR

(EVEN(INPUT)) OR (5 < INPUT)

SQR

SQR(9) SQR(INPUT)
SQR(9) gives 3, the square root of 9.

INT

INT(4.2) INT(INPUT/5)
INT(4.2) gives the value 4

RMD

RMD(8,3)
RMD(8,3) gives 2, the remainder of $8 \div 3$.

MAXIMUM

MAXIMUM(INPUT,10)

MINIMUM

MINIMUM(INPUT*3,20)

LCM

LCM(4,6) LCM(INPUT,24)
LCM(4,6) gives 12, the least common multiple of 4 and 6.

GCD

GCD(INPUT,5) GCD(20,8)
GCD(20,8) gives 4, the greatest common divisor of 20 and 8.

RANDOM

RANDOM(2,10) RANDOM(INPUT,20)
RANDOM(2,10) will randomly pick either
2, 3, 4, 5, 6, 7, 8, 9, or 10.

NIM SPEAK

Preparation

Purpose

Students will write strategies in Nim Speak.

Teacher Preparation

Run off 4 Nim Speak Sheets for each student.

Format
Groups of two

Time
30 minutes

Materials Needed
- 3 to 4 Nim Speak Worksheets per pair
- 1 Easy Speak Summary per student

Activity

Help students find partners. Each student needs an Easy Speak Summary and a few Nim Speak Sheets. (You can give them more as they need them.)

Tell students they now have a chance to write a strategy using Nim Speak. They can invent their own strategy (it can be easy or hard) or they can write one of the programs they already know. In either case they should START with 12, and the MAX should be 3.

While the students are working, walk around and observe.

* NIM SPEAK

Use

Purpose

Students will try out their Nim Speak strategies and get feedback from the computer.

Format
Groups of two

Time
4 days (20 minutes per group)

Materials Needed
- 1 computer with Nim Speak Program per pair
- filled-in Nim Speak Worksheets
- 1 Easy Speak Summary per student

Teacher Preparation

The activity takes about 4 days for the students to rotate through on the computers. The rest of the class needs to do something else. The students on the computer should not need much supervision.

Load the Nim Speak program before class (takes about 5 minutes).

Activity

Assign pairs to the computer. Each pair will need about 20 minutes. Give each group a start and stop time to facilitate the changeover.

The pairs will type in their strategies and play with the computer.

Optional Activity

Nim Speak is a very rich program. If time and student interest permit, there is a great deal to be discovered using Nim Speak for a longer time.

Students can save their instructions on the Network and can play with strategies invented by students from other classes.

* NIM RATER

(Optional)

Format
Individuals or groups

Time
Variable (about 15 minutes per group)

Materials Needed
1 computer with Nim Rater Program and 4 Nim Rater Recording Sheets per group

Prerequisite
BASIC NIM-Exploration

Background

In the Nim Rater program, students can try for one of three ratings: Nim-Star, Nim-Superstar, and Nim-Master. For all ratings the computer will use a perfect strategy, and students must win 3 games in a row to attain a rating. For Nim-Star, the games played are Basic Nim (12 to start and max to burn is 3); for Nim-Superstar, the starting number changes, but the max to burn is still 3, and in Nim-Master, both numbers vary.

Thus, this activity is intended for students who want to learn or who want to check that they have learned the winning strategy for Nim games. If students have problems earning their ratings, they might get help by playing with "Coach" in the Guess My Strategy program.

Purpose

To help students learn and check if they have learned the perfect strategy for some Nim games.

Teacher Preparation

Run off some Nim Rater Recording Sheets (one for every two games, about 5 per session).

Activity

Students should have played Basic Nim in class. Then this program should be self-explanatory. While some students use this program, the rest of the class will be doing something else.

Nim Rater Recording Worksheet

Name or Group_____

1. Rating you tried

   Nim-Star

   Nim-Superstar

   Nim-Master

2. Who went first? You PET
3. Who won? You PET
4. If you lost, can you tell why?

   a. I went first instead of 2nd.

   b. I went 2nd instead of first.

   c. When there were _____ matches left, I took _____ instead of _____.

   d. I thought about it, but I can't tell.

   e. Other_____

Fill in the chart:

Start with:

Name	Burnt	Left

Nim Rater Recording Worksheet

Name or Group_____

1. Rating you tried

   Nim-Star

   Nim-Superstar

   Nim-Master

2. Who went first? You PET
3. Who won? You PET
4. If you lost, can you tell why?

   a. I went first instead of 2nd.

   b. I went 2nd instead of first.

   c. When there were _____ matches left, I took _____ instead of _____.

   d. I thought about it, but I can't tell.

   e. Other_____

Fill in the chart:

Start with:

Name	Burnt	Left

* CALENDAR GAME

(Optional)

Format
Individuals or groups of two

Time
Variable (about 15 minutes per group)

Materials Needed
1 computer with Calendar Game Program per group

Prerequisite
Basic Nim - Exploration

Background

The Calendar Game is an interesting variation of Nim. Two players take turns choosing dates later in the year. The one who arrives at December 31 wins. A date chosen must have either the day the same as the last one chosen with a later month, or the month the same as the last one chosen with a later day.

The winning strategy for this game is similar to the winning strategy for Nim. Thus, it is an ideal game for someone who has discvered the winning strategy for Nim (perhaps for students who are Nim Masters in the Nim Rater Program) and who are looking for a new challenge.

Purpose

To challenge students who know the winning strategy for Nim.

Teacher Preparation

Arrange for a student or a group of students to use the computer while the rest of the class is doing something else. (You don't need to know how to win this game.)

Activity

Have students who are interested play the Calendar Game in pairs at their seats first. (See the rules under "Background".)

Have students play the game on the computer. (It is self-explanatory.)

Worksheets

GUESS MY STRATEGY WORKSHEET

Be sure to tell the PET you want (A), Playing Against My Strategy. You can choose One-Track, Obsessed, or Very Cool.

Play as long as necessary with the same program until you think you know its strategy.

1. Circle the name of the program you select:

   A. One-Track B. Obsessed C. Very Cool D. Xerox

2. Describe your program's strategy.

3. How does your program feel about going first?

4. Do you think your program is a good player? Why?

See if you can imitate your program!

Turn page over to record games.

Game 1

Start With:_____

Max to Burn:_____

If your program had a choice, did it choose to go FIRST or SECOND (circle one)?

Player **Burnt** **No.Left**

Game 2

Start With:_____

Max to Burn:_____

If your program had a choice, did it choose to go FIRST or SECOND (circle one)?

Player **Burnt** **No.Left**

Game 3

Start With:

Max to Burn:_____

If your program had a choice, did it choose to go FIRST or SECOND (circle one)?

Player **Burnt** **No.Left**

Game 4

Start With:

Max to Burn:_____

If your program had a choice, did it choose to go FIRST or SECOND (circle one)?

Player **Burnt** **No.Left**

Nim Speak Sheet

Programmer:

START WITH:

MAX TO TAKE:

START CONDITION:

1. CONDITION:

   TAKE:

2. CONDITION:

   TAKE:

3. CONDITION:

   TAKE:

4. CONDITION:

   TAKE:

5. CONDITION:

   TAKE:

6. CONDITION:

   TAKE:

7. CONDITION:

   TAKE:

8. CONDITION:

   TAKE:

9. CONDITION:

   TAKE:

10. CONDITION:

    TAKE:

EASY SPEAK SUMMARY

+	addition	=	equals
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MAXIMUM(INPUT,10)

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MINIMUM(INPUT*3,20)

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LCM(4,6) LCM(INPUT,24)
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GCD(INPUT,5) GCD(20,8)
GCD(20,8) gives 4, the greatest common divisor of 20 and 8.

RANDOM

RANDOM(2,10) RANDOM(INPUT,20)
RANDOM(2,10) will randomly pick either
2, 3, 4, 5, 6, 7, 8, 9, or 10.

Nim Rater Recording Worksheet

Name or Group_____

1. Rating you tried

   Nim-Star

   Nim-Superstar

   Nim-Master

2. Who went first? You PET
3. Who won? You PET
4. If you lost, can you tell why?

   a. I went first instead of 2nd.

   b. I went 2nd instead of first.

   c. When there were _____ matches left, I took _____ instead of _____.

   d. I thought about it, but I can't tell.

   e. Other_____

Fill in the chart:

Start with: Name	Burnt	Left

Nim Rater Recording Worksheet

Name or Group_____

1. Rating you tried

   Nim-Star

   Nim-Superstar

   Nim-Master

2. Who went first? You PET
3. Who won? You PET
4. If you lost, can you tell why?

   a. I went first instead of 2nd.

   b. I went 2nd instead of first.

   c. When there were _____ matches left, I took _____ instead of _____.

   d. I thought about it, but I can't tell.

   e. Other_____

Fill in the chart:

Start with: Name	Burnt	Left

STRATEGY 1.1

```
READY.

 0 REM"S=DSAVE"@STRATEGY 1.1"
 1 GOTO10
 2 FORT=1TO10:POKED3,X-20*T:PRINTF1$;:FORW=1TO5:NEXT:PRINTF2$;
 3 FORW=1TO5:NEXT:NEXT:POKED3,0:PRINTCL$;:RETURN
 10 AM=0:DIMTA(19),C$(54)
 12 CX=1:SP=PEEK(59271):SP=(-88*(SP=170ORSP=29)-49*(SP=210)):SND=1
 14 POKE144,SP:SP=SP-3
 20 MA$="■■■■■■■■●■■■■■■■■
```

```
375 C$(53)="■■■■■■■■■■■■EVIL WINS AGAIN":C$(54)="■■■■■GOOD TRY!
499 GOTO1000
500 REMGET$
505 IFA$=0THENA$=3
510 GOSUB9000:POKE158,0:W=TI:R$="":S$=""
520 GOSUB8000
580 CO=ASC(A$):IFCO=13THENRETURN
590 IFR$<>""ANDCO=20THENPRINT" ■■■ ■■";: R$=LEFT$(R$,LEN(R$)-1)
600 IFCO<32OR(CO>127ANDCO<151)THEN520
610 IFLEN(R$)=LNTHEN520
615 IFA$=CHR$(34)THEN520
620 PRINTA$;:R$=R$+A$:GOTO520
700 TE=NU-INT(NU/(MA+1))*(MA+1):RETURN
710 TU=NU-INT(NU/(MA+1))*(MA+1):RETURN
750 REMCLEAN
760 PRINT"■■■■";:FORN=1TO11:PRINT LEFT$(L$,19):NEXT:PRINT"■■■■■":RETURN
800 PRINT"■":FORN=1TO6:IFN=4THENPRINT"■■■■■■■■■■";
810 PRINTC$(N);C$(N+6);:NEXT:PRINT:PRINT:RETURN
820 A$=6:GOSUB9000:PRINTC$(6):PRINT" WHY DON'T YOU":PRINT"  THINK AGAIN.";
830 FORW=1TO3000:NEXT:RETURN
850 PRINT"  TO GO ON■■■■■■■■■■■■PRESS ■RETURN■ ";:GOSUB500:RETURN
1000 REM MAIN ROUTINE
1005 PRINT"■":GOSUB 19800
1010 A$=1:GOSUB9000:PRINT"■PLEASE ENTER YOUR NAME
1020 PRINT"(8 LETTERS OR LESS)■■■■■■";:LN=8:GOSUB500:GOSUB20400:N$(7)=R$
1030 IFR$=""THENN$(7)="YOU"
1070 LI=0:OB=1:POKE59468,14
1075 PRINT"■"LEFT$(D$,6)
1080 PRINT"   OOULD YOU LIKE TO:":PRINT:PRINT"■  ■A■. PLAY AGAINST MY STRATEGY?
1110 PRINT"■  ■B■. IMITATE MY STRATEGY?
1120 PRINT"■  ■C■. RAMBLE ON TWO STRATEGIES?
1130 PRINT:PRINTTAB(9);"ENTER ■A■, ■B■, OR ■C■. ";:A$=5:LN=1:GOSUB500
1150 IF(R$<"A")OR(R$>"C")THEN1070
1155 PRINT"■":POKE59468,12
1160 G$=R$:ON(ASC(G$)-ASC("@"))GOTO2000,5000,4000
2000 REMPLAY
2010 GOSUB800:PRINT"■WHICH STRATEGY WOULD":PRINT"YOU LIKE TO PLAY AGAINST?
2040 PRINT"ENTER A NUMBER. (1 THRU 6) ";
2070 LN=1:GOSUB500:IF(R$<"1")OR(R$>"6")THEN2010
2080 P=VAL(R$):Z$=N$(P):NU=FNR(9)+10:MA=FNR(5)+1
2100 PRINT"■":GOSUB10000:PRINT"■■"N$(P)"■VS■"N$(7)
2110 PRINT"■■";TAB(23);C$(P);C$(P+12):PRINT"■■START WITH:   "NU
2130 PRINT"MAX TO BURN:  "MA
2140 GOSUB750:PRINT"DO YOU WANT TO":PRINT"CHOOSE WHO WILL":PRINT"GO FIRST?
2170 PRINT"ENTER ■Y■ OR ■N■. ";
2180 GOSUB500:WH$=R$:IFR$<>"Y"ANDR$<>"N"THEN2140
2192 IFR$<>"N"ORP<>6ORT3THEN2200
2195 T3=1:GOSUB750:PRINT"■■":GOSUB820:GOTO2140
2200 T3=0:IF(R$="N")THEN P1=P:P2=7:GOTO2300
2215 GOSUB750:PRINT"WOULD YOU LIKE":PRINT"TO GO FIRST OR":PRINT"SECOND?
2250 PRINT"ENTER ■F■ OR ■S■.";:GOSUB500:IFR$<>"F"ANDR$<>"S"THEN2215
2255 IFP<>6ORTR=2THEN2280
2260 GOSUB700:IF((TE=0)AND(R$="S"))OR((TE<>0)AND(R$="F"))THEN2280
2265 GOSUB750:PRINT"■■":TR=2:GOSUB820:GOTO2215
2280 P1=7:P2=P:IF(R$="S")THENP1=P:P2=7
2300 FI$=R$:P3=7:GOSUB750:GOSUB15000
2330 GOSUB18000:IFNU<>0THEN2330
2350 IFNA$=N$(P)THEN2380
2360 PRINT"■■■■"TAB(14)C$(P)C$(P+18)
2370 GOTO2390
```

```
2380 PRINT"■■■■"TAB(14)C$(P)C$(P+48)
2390 PRINT"■■■"TA$
2400 PRINTTAB(11);"ENTER ■Y■ OR ■N■.";:LN=1:GOSUB500
2410 IFR$="Y"THENGOSUB16000:GOSUB850
2440 GOTO1070
4000 REMGAMBLE
4005 OB=1:TW=0:W1=0:W2=0:T4=0:T5=0:T1=0:T2=0:GOSUB800:PRINT
4010 PRINT"    WHO WOULD YOU LIKE":PRINT"    TO BE THE FIRST PLAYER?"
4030 PRINT"    ENTER A NUMBER (1 TO 6) ";
4040 GOSUB500:IFR$<"1"ORR$>"6"THEN4005
4070 P1=VAL(R$):P=P1
4080 GOSUB800:PRINT:PRINT"     WHO WOULD YOU LIKE"
4100 PRINT"     AS THE SECOND PLAYER?":PRINT"     ENTER A NUMBER (1 TO 6) ";
4120 GOSUB500:IFR$<"1"ORR$>"6"THEN4080
4140 P2=VAL(R$):IFP1=P2THENTW=1
4150 P3=P2:IFP1=4ORP2=4THENGOSUB4900
4180 PRINT"■■■■";TAB(3);C$(P1);C$(P1+12):PRINT"■■■■"TAB(22);C$(P2);C$(P2+12)
4190 IFTWTHENPRINT"■■■■"TAB(34)"■#2■■■■■■■■
4200 PRINTTAB(7);"■■■■WHO DO YOU THINK WILL WIN?":AS=3:GOSUB9000
4210 PRINTTAB(7)"ENTER"P1"OR"P2;:IFTWTHENPRINT"#2 ";
4220 PRINT"■■. ";:LN=4:GOSUB500:IFVAL(R$)<>PANDVAL(R$)<>P3THEN4180
4230 IFTWANDRIGHT$(R$,2)="#2"THENT2=1:T1=0:GOTO4240
4235 IFTWTHENT1=1:T2=0
4240 WI=VAL(R$):PRINT:PRINTTAB(6)"■■(TO PAUSE DURING PLAY
4245 PRINTTAB(8)"HOLD DOWN ANY KEY)
4250 PRINT TAB(7);"■■■■■■■HOW MANY DOLLARS WOULD YOU"
4260 PRINTTAB(7);"LIKE TO BET? $■_____■■■■■■■■
```

```
4900 C$(16)=LEFT$(C$(16),LEN(C$(16))-4):IFP1=4THEN4940
4920 IFP1=1ORP1=2ORP1=3THEN4960
4930 GOTO4950
4940 IFP2=1ORP2=2ORP2=5THEN4960
4950 C$(16)=C$(16)+"HIM!":RETURN
4960 C$(16)=C$(16)+"HER!":RETURN
5000 REM MIMIC
5005 LO=0
5010 GOSUB800:PRINT:PRINTTAB(7)"WHICH STRATEGY WOULD":PRINTTAB(7)"YOU LIKE T";
5030 PRINT"O IMITATE? ";:LN=1:GOSUB500:IFR$<"1"ORR$>"6"THEN5010
5035 P=VAL(R$):Z$=N$(P):PRINT"■■";TAB(10)C$(P);C$(P+24):PRINT"■■   HENCEFORT";
5060 PRINT"H YOU WILL BE CALLED:■■■":PRINTTAB(10)"PSEUDO-"N$(P)".■■■
5080 PRINTTAB(11);:GOSUB850
5100 PRINT"■   YOU WILL BE TRYING TO IMITATE■":PRINTN$(P)" PLAYING WITH AN O";
5110 PRINT"PPONENT■":PRINT"WHO CHOOSES THE NUMBER OF MATCHES TO■":PRINT"BURN":
5120 PRINT" RANDOMLY.  IF YOU DO NOT PLAY AS■":PRINTN$(P)" WOULD PLAY, I'LL ";
5130 PRINT"TELL YOU YOU■":PRINT"WERE WRONG AND SCORE A POINT AGAINST YOU
5140 IFP<>6THEN5190
5170 PRINT"■■   AS COACH, YOU MAY HAVE TO COACH■":PRINT"YOUR OPPONENT.
5180 PRINT"■   TO DO THAT, PRESS ■C■ INSTEAD OF
5185 PRINT"    ■RETURN■ AFTER YOUR OPPONENT'S MOVE
5190 PRINTTAB(8)"■■";:GOSUB850
5220 NU=FNR(9)+10:MA=FNR(5)+1:P3=8:PRINT"■■PSEUDO-"N$(P):PRINT"START WITH  :";
5250 PRINTNU:PRINT"MAX TO BURN :"MA:LI=0:GOSUB15000:GOSUB10000
5290 GOSUB750:PRINT"WOULD YOU LIKE":PRINT"TO GO FIRST OR":PRINT"SECOND?"
5330 PRINT"ENTER ■F■ OR ■S■ ";:LN=1:GOSUB500:IFR$<>"F"ANDR$<>"S"THEN5290
5355 PL=0:N1$="PSEUDO":N2$="OPPONENT"
5360 IFR$="S"THENPL=1:N1$=N2$:N2$="PSEUDO"
5380 PR=0:ONPGOTO5420,5410,5420,5410,5390,5390
5390 IFNU-INT(NU/(MA+1))*(MA+1)=0THENPR=1
5400 GOTO5420
5410 PR=1
5420 IFPR=PLTHEN5435
5430 GOSUB20000:IFP=4THENZE=1
5435 IFPL=1THEN5625
5440 GOSUB700
5450 GOSUB750:IFLI=1THENST$=N$(7)
5460 PRINT"HOW MANY WOULD":PRINT"YOU LIKE TO BURN?":PRINT"ENTER (1 TO"MA"■) ";
5500 LN=1:GOSUB500:IFR$<"1"ORVAL(R$)>MAXORVAL(R$)>NUTHEN5450
5520 PL=VAL(R$):ONPGOTO5550,5560,5580,5600,5540,5540
5540 PR=NU-INT(NU/(MA+1))*(MA+1):IFPR=0THENPR=PL
5547 GOTO 5610
5550 PR=MA
5553 IFPR>NUTHENPR=NU
5555 GOTO5610
5560 PR=1
5570 IFNU<=MATHEN5540
5575 GOTO 5610
5580 IFPR=1THENPR=2:GOTO5610
5590 PR=1:GOTO5610
5600 PR=TU:GOTO5553
5610 IFPR<>PLTHENGOSUB20000
5620 GOSUB750:NA$="PSEUDO":TU=PL:GOSUB15000:GOSUB12000
5625 IFNU=0THEN6000
5626 IFLI=1THENST$="OPPONENT"
5630 TU=FNR(MA):IFTU>NUTHENTU=NU
5640 GOSUB700:GOSUB750:PRINT"YOUR OPPONENT":PRINT"WILL BURN"TU"■.
5665 IFP<>6THEN5775
5670 GOSUB850
5700 IFR$<>"C"AND(TE=TUORTE=0)THEN5775
```

```
5710 IFR$="C"ANDTE<>0ANDTU<>TETHEN5775
5715 IFR$="C"THENGOSUB20000:GOTO5775
5730 GOSUB750:PRINTC$(6):PRINT"I WOULD'VE SAID":PRINT"   SOMETHING.
5760 FORW=1TO3000:NEXT:GOSUB750
5775 NA$="OPPONENT":GOSUB15000:GOSUB12000:IFNU<1THEN6000
5790 GOTO 5440
6000 PRINT"■■";TAB(13)C$(P);:IFLO>2THEN6090
6020 IFLO>0THEN6070
6030 PRINTC$(P+30):PRINT"■■YOU PLAYED LIKE ";N$(P);" EVERY TIME.":GOTO6110
6070 PRINTC$(P+36):GOTO6100
6090 PRINT C$(P+42)
6100 PRINT "■■YOU DIDN'T PLAY LIKE "N$(P);LO"TIME(S)"
6110 PRINT"■■"TA$:PRINT"      (■Y■ OR ■N■)";
6130 LN=1:GOSUB500:IFR$="Y"THENGOSUB16000
6160 PRINT"■":GOSUB850:GOTO1070
8000 REM**GET SINGLE CHAR
8010 GETA$:IFA$<>""THENPRINT" ■";:GOTO8040
8020 CT=CT+1:IFCT>8THENPRINTMID$(" ■",CX,1)"■";:CX=3-CX:CT=0
8030 GOTO8010
8040 IFA$=CHR$(3)THEN20200
8050 IFA$=CHR$(147)THEN SND=0
8060 IFA$=CHR$(19)THEN SND=1
8070 RETURN
9000 REMSOUND
9002 IFSND=0THENRETURN
9005 D1=59467:D2=59466:D3=59464:D4=16:D5=15:D6=85:D7=51
9010 ONASGOSUB9405,9665,9250,9390,9095,9345
9025 AS=0:POKED1,0:POKED3,0:RETURN
9095 REM AS=5*ZAP
9100 POKE D1,D4:POKE D2,D5
9105 FOR SI=10TO 255 STEP 10:POKE D3,SI:NEXT
9110 RETURN
9250 X=INT(RND(1)*4)+2:FORSI=1TOX:D8=INT(RND(1)*240)+15:POKED1,D4:POKED2,D5
9260 POKED3,D8:FORSJ=1TO35:NEXT:POKED3,0:FORSJ=1TO30:NEXT:NEXT:RETURN
9345 POKED1,D4:POKED2,D7:POKED3,177:FORW=1TO100:NEXT
9360 POKED3,251:FORW=1TO140:NEXT:RETURN
9390 X=INT(RND(1)*200)+55:POKED1,D4:POKED2,D5:POKED3,X:FORSJ=1TO35:NEXT:RETURN
9405 REM AS=1*FANFARE
9410 POKE D1,D4:POKE D2,D5
9415 S1=8:S2=237:GOSUB9660
9420 S1=8:S2=211:GOSUB9660
9425 S1=8:S2=188:GOSUB9660
9430 S1=4:S2=158:GOSUB9660
9435 S1=8:S2=211:GOSUB9660
9440 S1=1:S2=158:GOSUB9660
9445 RETURN
9660 POKED3,S2:FORSI=1TO600/S1:NEXT:POKED3,0:FORSI=1TO5:NEXT:RETURN
9665 REM VS=3*FLASH/BUZZ
9670 POKE 59464,255:POKE 59466,15
9675 FOR VI=1TO100:POKE 59468,194:POKE 59468,12:NEXT
9680 POKE 59466,0:RETURN
10000 REMMATCH
10010 PRINT"■";:PRINTLEFT$(D$,23);:FORN=1TONU:PRINTMA$"■■■";:AS=4:GOSUB9000
10060 N$=STR$(INT(N/10)):N$=N$+"■":IFINT(N/10)=0THENN$=" "
10080 PRINT"■"N$"■■";:PRINTN-10*(INT(N/10));:NEXT:RETURN
12000 REMBURN
12010 PRINT"■";:PRINTLEFT$(D$,12);:PRINTTAB(NU*2-2);:POKED1,D4:POKED2,D5
12030 FORN=1TOTU:X=255:IFNU=1THENN=TU:NEXT:GOTO12120
12110 GOSUB2:PRINTBU$;:NU=NU-1:NEXT:RETURN
12120 PRINT"■";LEFT$(L$,19);LEFT$(D$,17);MA$;"■";:FORD=6TO12:PRINTLEFT$(D$,D);
```

```
12160 PRINTLEFT$(L$,19);
12210 GOSUB2:PRINT"■";:NEXT:PRINTLEFT$(D$,D+1);LEFT$(L$,20);:POKED1,0
12260 PRINT"■■■■POOF!■■";:AS=2:GOSUB9000:NU=NU-1:PRINT"■";:RETURN
15000 REMTABLE
15010 PRINT"■";:AS=4:GOSUB9000:IFLI<>0THEN15020
15016 PRINTTAB(20)"■  PLAYER  BURNT #  ■":FORM=1TO11
15018 PRINTTAB(20)"|           |    |    |":NEXT:BE=NU:LI=1:RETURN
15020 PRINTLEFT$(D$,LI-1):PRINTTAB(20)"| ";
15032 RV$="■":IFINT(LI/2)=LI/2THENRV$="■"
15035 PRINTRV$NA$"■     ■":PRINTTAB(30)" |"RV$TU"■":PRINTTAB(34)" |"RV$NU-TU"■
15050 PRINTTAB(38)" |":TA(LI)=TU:LI=LI+1:RETURN
16000 REMRE-BUILD TABLE
16010 PRINT"■":TE=LI-1:LI=0:NU=BE
16020 IFG$<>"C"THENN1$=N$(P1):N2$=N$(P2)
16030 FORN=0TOTE
16035 :  NA$=N1$:IF N/2=INT(N/2) THEN NA$=N2$
16040 :  TU=TA(N):GOSUB15000:NU=NU-TU
16080 NEXT:PRINT"■";LEFT$(D$,15);
16090 RETURN
18000 REM
18001 GOSUB750:IFLI>1THEN18110
18002 IF FI$="F"ORP1<>4THEN18040
18003 GOTO18060
18005 IFT4THENPRINTTW$;
18006 PRINTC$(P1)+"■■■■■■■■■■■■■■I DON'T LIKE":PRINT" TO GO FIRST";
18007 FORW=1TO2000:NEXT:GOSUB750:GOTO18060
18040 IFWH$="N"THENONP1GOTO18110,18060,18110,18060,18050,18050
18042 GOTO18100
18050 IF(NU-INT(NU/(MA+1))*(MA+1))<>0THEN18110
18055 Z=P1:P1=P2:P2=Z:Z=T1:T1=T2:T2=Z:IFP1=4THEN18005
18056 GOTO18109
18060 Z=P1:P1=P2:P2=Z:Z=T1:T1=T2:T2=Z:IFTW=0ANDP1=4THEN18006
18100 IFNU=0THENRETURN
18109 IFTWANDP<>1ANDP<>3THENZ=T4:T4=T5:T5=Z
18110 ST$=N$(P1):IFTWANDP=4ANDLI=1THEN18112
18111 GOTO18115
18112 IFT5THENPRINTTW$;
18113 PRINTC$(P):PRINT"■OH WELL, IF I MUST":FORW=1TO2000:NEXT:GOSUB750
18115 IFT5THENPRINTTW$;:OB=OB+1:IFOB>2THENOB=1
18120 ONP1GOSUB19100,19200,19300,19500,19000,19400,19600
18121 AS=3:GOSUB9000
18125 IFPEEK(151)<>255THEN18125
18130 IFP1<>7THENFORW=1TO1200:NEXT
18140 NA$=N$(P1):GOSUB15000
18150 GOSUB12000:GOSUB750
18200 IFNU=0THENW1=1:RETURN
18205 IFT4THENPRINTTW$;:OB=OB+1:IFOB>2THENOB=1
18210 ONP2GOSUB19100,19200,19300,19500,19000,19400,19600
18211 AS=3:GOSUB9000
18215 IFPEEK(151)<>255THEN18215
18220 IFP2<>7THENFORW=1TO600:NEXT
18230 NA$=N$(P2):GOSUB15000:GOSUB12000:GOSUB750:RETURN
19000 REM7 PLAY ROUTINES
19010 GOSUB710:IFTU=0THENTU=FNR(MA)
19020 PRINTC$(5)+"■■■■■■■■■■I WILL BURN"TU"■■.":RETURN
19100 TU=MA:IFNU<MATHENTU=NU
19120 PRINTC$(1)+"()":PRINT" I WILL BURN"TU"■■.":RETURN
19200 TU=1:IFNU>MATHEN19230
19220 TU=NU
19230 PRINT"   "C$(2):PRINT"  I WILL BURN"TU"■■.":RETURN
```

```
 19300 TU=OB:IFOB=1THENOB=2:GOTO19330
 19320 OB=1
 19330 IFTU>NUTHENTU=NU
 19335 PRINTC$(3);"      |■■■■■■■■|└┘└┘└┘└┘":PRINT" I WILL BURN"TU"■■.":RETURN
 19400 GOSUB710:IFTU=0THENTU=FNR(MA)
 19420 PRINT"┐"C$(6):PRINT" I WILL BURN"TU"■■.":RETURN
 19500 IFTU>NUTHENTU=NU
 19505 IFTU>MAORTU=0THENTU=FNR(MA)
 19510 PRINTC$(4);"■■■■■┌──■■■■■■■■■■I WILL BURN";TU;"■■.":RETURN
 19600 TR=1
 19605 GOSUB750:PRINT"HOW MANY MATCHES":PRINT"WOULD YOU LIKE TO":PRINT"BURN?";
 19620 PRINT" ENTER NUMBER":PRINT"(1 TO"MA"). ";:GOSUB500
 19650 TU=VAL(R$):IFTU<1ORTU>MAORTU>NUTHEN19600
 19670 GOSUB700:IFTE=0ORTE=TUORP<>6ORTR=2THENRETURN
 19690 TR=2:GOSUB750:PRINT"┌┐"
 19700 GOSUB820:GOTO19605
 19800 REM**TITLE PAGE
 19805 POKE59468,14
 19810 PRINTTAB(11)"■■| ┌─♥♥ \ | ♥|_♠| ─| ■■
 19812 PRINTTAB(6)"♠ PART OF THE ♥|_♠| ─| | ┌NIT■
 19820 PRINT" BY THE \ATH ┌ETWORK ┤URRICULUM ─ROJECT■
 19830 PRINTTAB(16)"♥_♥ ┌■■■■■■■■4.0 |♠♥-\_■
 19840 PRINTTAB(12)" ┌SES -|2 SOUND
 19850 PRINTTAB(10)"─ISABLE WITH [┤└_]
 19860 PRINTTAB(10)"─NABLE WITH [ |┌\─]
 19870 RETURN
 20000 REMMIMICERROR
 20010 GOSUB750:IFZETHENZE=0:RETURN
 20020 LO=LO+1:PRINTC$(P);:ONPGOTO20050,20090,20070,20080,20090,20090
 20050 PRINT"()":GOTO20090
 20070 PRINT"      |■■■■■■■■|└┘└┘└┘└┘";:GOTO20090
 20080 PRINT"■■■■■┌──";
 20090 PRINT:PRINT"I WOULDN'T HAVE":PRINT"  DONE THAT.":A$=6:GOSUB9000
 20100 FORW=1TO2000:NEXT:GOSUB750:RETURN
 20200 REM END - CALLED BY USER RUN/STOP
 20220 PRINT"┐■■■GOOD-BYE FROM ALL THE PLAYERS!
 20230 PRINT"■■COME BACK AGAIN, PLEASE.
 20235 POKE144,SP
 20240 END
 20400 REM---R$ ALL CAPS---
 20410 IFR$=""THENRETURN
 20420 FORI=1TOLEN(R$)
 20430 R$=LEFT$(R$,I-1)+CHR$(ASC(MID$(R$,I))AND127)+MID$(R$,I+1)
 20440 NEXTI
 20450 RETURN
READY.
```

NIMSPK 3.5 DCAT

```
READY.

 10 SYS1039:RUN
READY.


READY.

 3 GOTO19000
 4 PRINT"■■■■":FORN=1TO11:PRINTLEFT$(L$,18):NEXT:PRINT"■■■■":RETURN
 6 B$=""
 7 GOTO8600
 9 REMCOPYRIGHT1981,MNCP,SFSU
 100 LV=LV-1:RETURN
 200 REM-NTIN
 210 I$="":D1$="R"
 220 GOSUB400:IF(PEEK(SQ)ANDRF)<>1THEN220
 230 SYSRX:A$=CHR$(PEEK(RB)):IFA$=RT$THENPRINT"■ ■■";:SYSSD:RETURN
 240 I$=I$+A$:GOTO220
 400 REM-BLNK
 410 IFDTHENPRINT"■"D1$"■■";:D=FA:RETURN
 420 PRINT"■"D1$"■■";:D=TR:RETURN
 600 REM-NTOT
 610 SYSBS:D1$="S":FORI=1TOLEN(O$):GOSUB400:POKEXB,ASC(MID$(O$,I,1)):SYSTX
 615 NEXT
 620 POKEXB,13:SYSTX:PRINT"■ ■■";:GOTO200
 800 REM X,Y
 810 PRINT"■":PRINT"■";:IFY=0ANDX=0THENRETURN
 820 IFY=0THENPRINTTAB(X);:RETURN
 830 IFX=0THENPRINTLEFT$(D$,Y);:RETURN
 840 PRINTLEFT$(D$,Y)TAB(X);:RETURN
 2500 SK$(SS)=SK$:SS=SS+1:GOTO400
 2600 SS=SS-1:SK$=SK$(SS):GOTO400
 2700 SK(SN)=SK:SN=SN+1:GOTO400
 2800 SN=SN-1:SK=SK(SN):GOTO400
 2900 P0$=P1$:IFP1>LEN(I$)THENP1$="":RETURN
 2920 IFMID$(I$,P1,1)=" "THENP1=P1+1:GOTO2900
 2930 P1$=MID$(I$,P1,1):P1=P1+1:RETURN
 3000 D1$="T":GOSUB3200:GOSUB3400:IFNOTREORERTHEN3040
 3020 IFP1$<>""THENRE=FA:GOTO3040
 3030 GOSUB2600:O$=SK$
 3040 PRINT"■ ■■";:RETURN
 3200 P0=1:P1=1:GOSUB2900:ER=FA:O1=FA:RE=TR:SS=0:SN=0:O$="":LV=0:OV=15:RETURN
 3400 LV=LV+1:IFLV>OVTHEN400
 3405 GOSUB3600:IFNOTRETHEN100
 3410 GOSUB5200:IFNOTRETHENRE=TR:GOTO100
 3420 GOSUB3600:IFNOTRETHENRE=FA:ER=TR:GOTO100
 3430 GOSUB2600:E1$=SK$:GOSUB2600:R$=SK$:GOSUB2600:E2$=SK$
 3440 SK$=R$+" "+E2$+" "+E1$:GOSUB2500:GOTO3410
 3600 LV=LV+1:IFLV>OVTHEN400
 3605 P2%(LV-2)=1:GOTO3800
 3607 IFNOTRETHEN100
 3610 GOSUB5000:IFNOTRETHENRE=TR:GOTO100
 3620 P2%(LV-2)=2:GOTO3800
 3625 IFNOTRETHENRE=FA:ER=TR:GOTO100
 3630 GOSUB2600:T$=SK$:GOSUB2600:R$=SK$:GOSUB2600:E$=SK$
 3640 SK$=R$+" "+E$+" "+T$:GOSUB2500:GOTO3610
```

```
3800 REMTRM
3805 P3%(LV-2)=1:GOTO4000
3807 IFNOTRETHEN3990
3810 GOSUB4800:IFNOTRETHENRE=TR:GOTO3990
3820 P3%(LV-2)=2:GOTO4000
3825 IFNOTRETHENRE=FA:ER=TR:GOTO3990
3830 GOSUB2600:F$=SK$:GOSUB2600:R$=SK$:GOSUB2600:T$=SK$
3840 SK$=R$+" "+T$+" "+F$:GOSUB2500:GOTO3810
3990 ONP2%(LV-2)GOTO3607,3625
4000 REMFACTOR
4005 GOSUB5000:SK=RE:GOSUB2700
4010 P4%(LV-2)=1:GOTO4200
4011 IFERTHEN4190
4012 SK=RE:GOSUB2700
4015 GOSUB5300:IFNOTRETHENRE=TR:GOTO4035
4020 P4%(LV-2)=2:GOTO4200
4022 IFNOTRETHENER=TR:GOTO4190
4025 GOSUB2600:F2$=SK$:GOSUB2600:P$=SK$:GOSUB2600:F1$=SK$
4030 SK$=P$+" "+F1$+" "+F2$:GOSUB2500:GOTO4015
4035 GOSUB2800:IFNOTSKTHEN4190
4040 GOSUB2800:IFNOTSKTHEN4190
4145 GOSUB2600:F$=SK$:GOSUB2600:R$=SK$:SK$=R$+" 0 "+F$:GOSUB2500
4190 ONP3%(LV-2)GOTO3807,3825
4200 REMPRIMARY
4205 IF(P1$)="0"ANDP1$<="9")ORP1$="."THENGOSUB4600:GOTO4390
4210 IFP1$)="A"ANDP1$<="Z"THENGOSUB 4400:GOTO4390
4220 IFP1$<>"("THENRE=FA:ER=TR:GOTO4390
4230 GOSUB2900:GOSUB3400:IFNOTRETHENRE=FA:ER=TR:GOTO4390
4250 IFP1$<>")"THENRE=FA:ER=TR:GOTO4390
4260 RE=TR:GOSUB2900
4390 ONP4%(LV-2)GOTO4011,4022
4400 LV=LV+1:IFLV>OVTHEN400
4405 NM$=""
4420 IFP1$<"A"ORP1$>"Z"THEN4450
4430 GOSUB2900:NM$=NM$+P0$:GOTO4420
4450 S$="NOPQRSTUVWXYZ[\]↑":GOSUB5600
4470 IFNOTRETHENER=TR:GOTO100
4490 IFC$)="Z"THEN6200
4536 IFC$)="N"ANDC$<="T"THEN6400
4590 GOTO100
4600 SK$=""
4620 IFP1$<"0"ORP1$>"9"THEN4700
4630 GOSUB2900:SK$=SK$+P0$:GOTO4620
4700 IFP1$<>"."THEN4780
4710 IFLEN(SK$)=0THENSK$="0"
4720 GOSUB2900:SK$=SK$+P0$
4730 IFP1$<"0"ORP1$>"9"THEN4780
4740 GOSUB2900:SK$=SK$+P0$:GOTO4730
4780 IFLEN(SK$)>0THENRE=TR:GOSUB2500:GOTO4790
4785 RE=FA
4790 RETURN
4800 IFP1$<>"*"ANDP1$<>"/"THEN RE=FA:RETURN
4810 GOSUB2900:NM$=P0$:GOSUB6000:RE=TR:SK$=C$:GOSUB2500:RETURN
5000 IFP1$<>"+"ANDP1$<>"-"THENRE=FA:RETURN
5010 GOSUB2900:NM$=P0$:GOSUB6000:RE=TR:SK$=C$:GOSUB 2500:RETURN
5200 NA=3:S$="IJKLM":GOSUB5400:IFRETHENRETURN
5210 IFP1$<>"="ANDP1$<>">"ANDP1$<>"<"THENRE=FA:RETURN
5220 GOSUB2900:NM$=P0$:GOSUB6000:SK$=C$:GOSUB2500:RE=TR:RETURN
5300 IFP1$<>"↑"THENRE=FA:RETURN
5310 GOSUB2900:NM$=P0$:GOSUB6000:SK$=C$:GOSUB2500:RE=TR:RETURN
```

```
5400 CC=1:IFP1$=""THENRE=FA:RETURN
5410 P0=P1:GOSUB2900:NM$=P0$:IFP1$="" THENRE=FA:P1=P0-1:GOSUB2900:RETURN
5430 GOSUB2900:NM$=NM$+P0$:CC=CC+1:GOSUB5600:IFRETHENRETURN
5450 IFCC=NAORP1$=""THENRE=FA:P1=P0-1:GOSUB2900:RETURN
5460 GOTO5430
5600 GOSUB6000:IFNOTRETHENRETURN
5620 RE=FA:FORC=1TOLEN(S$):IFMID$(S$,C,1)=C$THENRE=TR:C=LEN(S$)
5630 NEXT
5640 IFRETHENSK$=C$:GOSUB2500
5790 RETURN
6000 RE=FA:FORC=0TONK-1:IFNM$=KE$(C)THENRE=TR:C$=CHR$(C+OF):C=NK-1
6010 NEXT:RETURN
6200 IFP1$<>"("THEN6280
6210 GOSUB2900:GOSUB3400:IFNOTRETHEN6280
6220 IFP1$<>")"THEN6280
6230 GOSUB2900:GOSUB2600:F$=SK$:GOSUB2600:SK$=SK$+" "+F$:GOSUB2500:GOTO6290
6280 ER=TR:RE=FA
6290 GOTO100
6400 IFP1$<>"("THEN6480
6420 GOSUB2900:GOSUB3600:IFNOTRETHEN6480
6430 IFP1$<>","THEN6480
6440 GOSUB2900:GOSUB3600:IFNOTRETHEN6480
6450 IFP1$<>")"THEN6480
6460 GOSUB2900:GOSUB2600:F$=SK$
6470 GOSUB2600:F$=SK$+" "+F$
6475 GOSUB2600:SK$=SK$+" "+F$:GOSUB2500:GOTO6490
6480 ER=TR:RE=FA
6490 GOTO 100
7000 GOSUB7200:GOSUB7400:PRINT"■ ▮▮";:IFNOTRETHEN7040
7020 GOSUB2800:OU=SK
7040 PRINT"■ ▮▮";:RETURN
7200 P1=1:IFP1>LEN(I$)THENER=TR:RE=FA:RETURN
7220 P1$=MID$(I$,P1,1):IFP1$=" "THENP1=P1+1:GOTO7220
7240 P1=P1+1:ER=FA:RE=TR:SS=0:SN=0:RETURN
7400 RE=TR:C$=P1$:GOSUB8000
7410 IFC$>="0"ANDC$<="9"THENSK=VAL(T$):GOTO7580
7415 IFC$<"U"ORC$>"Y"THEN7470
7417 ONASC(C$)-(OF+R0-1)GOTO7420,7425,7430,7440,7450
7420 SK=BE:GOTO7580
7425 SK=MA:GOTO7580
7430 SK=TR:GOTO7580
7440 SK=FA:GOTO7580
7450 SK=NU:GOTO7580
7470 SK$=C$:GOSUB2500:GOSUB7400:GOSUB2600:C$=SK$:IFNOTRETHENRETURN
7500 GOSUB2800:V1=SK
7505 IFC$<"Z"ORC$>"↑"THEN7550
7507 ONASC(C$)-(OF+R1-1)GOTO7508,7510,7520,7530,7540
7508 SK=SQR(V1):GOTO7580
7510 SK=NOTV1:GOTO7580
7520 SK=NOT(0=V1-INT(V1/2)*2):GOTO7580
7530 SK=(0=V1-INT(V1/2)*2):GOTO7580
7540 SK=INT(V1):GOTO7580
7550 SK$=C$:GOSUB2500:SK=V1:GOSUB2700:GOSUB7400:GOSUB2600:C$=SK$
7560 IFNOTRETHENGOSUB2800:RETURN
7570 GOSUB2800:V2=SK:GOSUB2800:V1=SK:GOSUB7600
7580 GOSUB2700:RETURN
7600 ONASC(C$)-(OF+R2-1)GOTO7610,7615,7620,7625,7630,7635,7640,7645,7650,7655
7605 ONASC(C$)-(OF+R2+9)GOTO7660,7665,7670,8100,8150,7685,7690,7694,7696,7698
7610 SK=V1↑V2:RETURN
7615 SK=V1+V2:RETURN
```

```
7620 SK=V1-V2:RETURN
7625 SK=V1*V2:RETURN
7630 SK=V1/V2:RETURN
7635 SK=(V1=V2):RETURN
7640 SK=(V1<V2):RETURN
7645 SK=(V1>V2):RETURN
7650 SK=(V1<=V2):RETURN
7655 SK=(V1>=V2):RETURN
7660 SK=(V1<>V2):RETURN
7665 SK=(V1ANDV2):RETURN
7670 SK=(V1ORV2):RETURN
7685 SK=V1-INT(V1/V2)*V2:RETURN
7690 SK=FNR(V2-V1)+V1:RETURN
7694 SK=FA:IFINT(V2/V1)=V2/V1THENSK=TR
7695 RETURN
7696 SK=V1:IFV2>V1THENSK=V2
7697 RETURN
7698 SK=V1:IFV2<V1THENSK=V2
7699 RETURN
7800 P0$=P1$:IFP1>LEN(I$)THENP1$="":RETURN
7830 P1$=MID$(I$,P1,1):P1=P1+1:RETURN
8000 T$="":IFP1$=" "THENGOSUB7800:GOTO8000
8010 IFP1$=" "ORP1$=""THENGOSUB7800:GOTO8030
8020 GOSUB7800:T$=T$+P0$:GOTO8010
8030 IFP1$=" "THENGOSUB7800:GOTO8030
8040 RETURN
8100 IFV1<=V2THENV3=V2:GOTO8110
8105 V3=V1:V1=V2:V2=V3
8110 IFINT(V2/V1)<>V2/V1THENV2=V2+V3:GOTO8110
8120 SK=V2:RETURN
8150 IFV1=V2ORV2=0THEN8180
8155 V3=INT(V1-INT(V1/V2)*V2+.5):V1=V2:V2=V3:GOTO8150
8180 SK=V1:RETURN
8200 REM-CHAR-
8210 RE$=""
8220 IFTI<T+30THENPRINT"▒▒";:GOTO8250
8230 IFTI<T+60THENPRINT" ▒";:GOTO8250
8240 T=TI
8250 GETA$:IFA$=""THEN8220
8260 IFA$=AC$THENRE$=AC$
8270 IFA$=ES$THENRES$=ES$
8280 A=ASC(A$):PRINT" ▒";:RETURN
8400 REM-GET STRNG-
8402 PRINTB$;:CH=FA
8405 GOSUB8200
8410 IFB$=""ANDA=20THEN8405
8415 IFB$=""ANDA=13THENRETURN
8420 IFA=13THENRETURN
8425 IFRE$=ES$THENRETURN
8430 IFRE$=AC$THENRETURN
8440 IFA=20ANDLEN(B$)<2THENPRINT"▒ ▒";:B$="":CH=TR:GOTO8405
8445 IFA=20THENPRINT"▒ ▒";:B$=LEFT$(B$,LEN(B$)-1):CH=TR:GOTO8405
8450 IFA<32OR(A>127ANDA<161)THEN8405
8455 IFL1$<>""ANDA$<L1$THEN8405
8460 IFL2$<>""ANDA$>L2$THEN8405
8465 IFLEN(B$)>=LSTHEN8405
8470 PRINTA$;:B$=B$+A$:CH=TR
8475 IFA$=CHR$(34)THENPRINTCHR$(34)"▒";
8480 GOTO 8405
8600 REM-NON-EMTY-
```

```
8620 GOSUB8400
8630 IFRE$=ES$THENRETURN
8640 IFRE$=AC$THENRETURN
8650 IFB$=""ANDLS<>0THEN8620
8660 RETURN
8800 PRINT"■";LEFT$(D$,23);:FORN=1TONUM:OP=N-INT(N/10)*10:OP$=STR$(OP)
8840 TP=INT(N/10):TP$=STR$(TP):IFTP=0 THENTP$="  "
8850 PRINTMA$;"■■■";TP$;"■■■";OP$;" ";
8860 NEXT:PRINT"■":RETURN
9000 PRINT"■";LEFT$(D$,15);SPC((NUM*2)-2);
9050 FORN=1TOTU:FORW=1TO10:PRINTF1$;:PRINTF2$;:FORF=1TO20:NEXT:NEXT
9080 PRINTBU$;"■■■□□□□□□□";:NU=NU-1:NEXT:RETURN
9200 GOSUB4:PRINT"HOW MANY MATCHES":PRINT"WOULD YOU LIKE":PRINT"TO BURN?
9250 PRINT"( 1 -";MA;")□";:LS=1:L1$="1":L2$=CHR$(48-MA*(NU>=MA)-NU*(NU<MA))
9255 GOSUB6:TU=VAL(B$):IFRE$=ES$THENRETURN
9260 IFTU<1THEN9255
9290 PL$="YOU":GOSUB19200:RETURN
9400 REM MACH TURN
9410 N2=2:RT=0:GOSUB4
9420 N2=N2+1:I$=CO$(N2):GOSUB3000
9430 I$=O$:GOSUB7000:IFERORNOTRETHEN10800
9440 IFOU<>TRTHEN9500
9450 I$=EX$(N2):GOSUB3000
9460 I$=O$:GOSUB7000:IFERORNOTRETHEN10800
9470 IFOU<1OROU>MAOROU>NUTHEN11050
9480 RT=RT+1:IFRT=1THENR4=OU:L1=N2-2
9490 IFRT>1ANDR4<>OUTHEN11000
9500 IFN2<NL-1THEN9420
9510 IFRT=0THEN10900
9520 TU=R4:PL$="ME":GOSUB19200:RETURN
9600 REM CREATE
9610 GOSUB10000 INIT
9620 GOSUB9800EDIT
9630 RETURN
9800 REM EDIT
9805 EL=0:GOSUB10200
9810 L1$=" ":L2$=CHR$(255)
9815 CH=FA
9817 IFEL>6ANDEL<MLTHENGOSUB10200
9820 IFEL>ML-1THENEL=EL-1:NL=NL-1:ER$="MAX NUMBER OF LINES REACHED":GOSUB13200
9825 LS=-5*(EL<2)-64*(EL>1)
9835 Y=FNY(EL):IFEL>2THENX=0:GOSUB800:PRINTEL-2CN$
9840 X=FNX(EL):GOSUB800:IFNOTCHTHENB$=CO$(EL)
9845 GOSUB7:IFRE$=ES$THENGOSUB11200:GOTO9815
9850 IFRE$=AC$THENRETURN
9855 IFCHANDEL<2THENONEL+1GOSUB10400,10500:IFNOTRETHEN9820
9860 IFCHANDEL>1THENGOSUB10600:IFNOTRETHEN9820
9865 CO$(EL)=B$:IFEL<3THENEL=EL+1:NL=NL-(EL>NL):GOTO9815
9870 CH=FA:Y=Y+2:IFEL>2THENX=0:GOSUB800:PRINTTK$
9875 Y=FNY(EL)+2:X=FNX(EL):GOSUB800:IFNOTCHTHENB$=EX$(EL)
9880 GOSUB7:IFRE$=ES$THENGOSUB11200:GOTO9815
9885 IFCHTHENGOSUB10600
9890 IFCHANDNOTREANDRE$=AC$THENRETURN
9895 IFCHANDNOTRETHEN9875
9900 EX$(EL)=B$:EL=EL+1:NL=NL-(EL>NL)
9905 IFRE$=AC$THENRETURN
9910 GOTO9815
10000 REM INIT STRAT
10010 FORI=0TO13:CO$(I)="":EX$(I)="":NEXT:NL=0:RETURN
10200 REM LIST
```

```
10210 PRINT"■"TAB(11)"■NIMSPEAK STRATEGY
10220 IFEL>6THEN10260
10230 PRINT"START WITH: "TAB(FNX(0))CO$(0)
10240 PRINT"MAX TO TAKE: "TAB(FNX(1))CO$(1)
10250 PRINT"START CONDITION: "TAB(FNX(2))CO$(2):IFNL<4THEN10330
10260 S1=-3*(EL<7)-(EL-4)*(EL>6)
10270 S2=-(NL-1)*(EL<7ANDNL<7)-(NL-1)*(EL>6ANDNL<S1+5)-6*(EL<7ANDNL>6)
10280 IFS2=0THENS2=S1+4
10290 Y=1:IFEL<7THENY=5
10300 FORI=S1TOS2:X=0:GOSUB800
10310 PRINTI-2CN$TAB(FNX(I))CO$(I):Y=Y+2:GOSUB800
10320 PRINTTK$TAB(FNX(I))EX$(I):Y=Y+2:NEXT
10330 GOSUB13800:RETURN
10400 REM START
10410 RE=TR:IFB$="START"OR(VAL(B$)>11ANDVAL(B$)<21)THENRETURN
10420 ER$="MUST BE 'START' OR NUMBER FROM 12 TO 20":GOSUB13200:RE=FA:RETURN
10500 REM MAX
10510 RE=TR:IFB$="MAX"OR(VAL(B$)>1ANDVAL(B$)<7)THENRETURN
10520 ER$="MUST BE 'MAX' OR NUMBER FROM 2 TO 6":GOSUB13200:RE=FA:RETURN
10600 REM CNDTN
10610 I$=B$:GOSUB3000:IFRETHENRETURN
10620 ER$=UN$:GOSUB13200:RETURN
10800 GOSUB4:PRINTUN$:PRINT"LINE #";N2-2;".":ER=TR:RETURN
10850 GOSUB4:PRINT"START CONDITION MUST BE":PRINT"TRUE OR FALSE.":ER=TR:RETURN
10900 GOSUB4:PRINT"NONE OF THE CONDITIONS":PRINT"WERE TRUE. NO MOVE.":ER=TR
10910 RETURN
11000 GOSUB4:PRINT"LINE #"L1"AND LINE"
11020 PRINT"#"N2-2"TELL ME TO":PRINT"DO DIFFERENT THINGS":ER=TR:RETURN
11050 GOSUB4:PRINT"LINE #";N2-2:PRINT"TELLS ME TO TAKE"OU
11070 PRINT"MATCHES, AND THAT'S":PRINT"ILLEGAL.":ER=TR:RETURN
11200 REM EDIT ESCAPE
11205 IFEL<3THENRETURN
11210 FORI=ELTONL:CO$(I)=CO$(I+1):EX$(I)=EX$(I+1):NEXT
11220 NL=NL+(NL>0):EL=EL+(EL>0)
11230 IFEL<7THENGOSUB10200
11240 RETURN
12000 REM NETLD
12010 PRINT"■■NETLOAD":GOSUB12800:IFRE$=ES$THENRETURN
12050 PRINT:PRINT"NAME OF":PRINT"STRATEGY TO LOAD: ";
12052 GOSUB15000:IFRE$=ES$THENRETURN
12060 O$="DNR"+B$:GOSUB600:IFLEFT$(I$,4)<>"DNRT"THENPRINT"NOT FOUND":GOTO12050
12070 NL=-1
12080 NL=NL+1:GOSUB12200:IFERTHEN12050
12090 IFREANDNL>3THENPRINT"■"B$"LOADED":GOSUB14200:RETURN
12100 IFREANDNL<4THENPRINT"■NOT ENOUGH LINES":GOTO12050
12110 CO$(NL)=MID$(I$,9):IFNL<3THENGOTO12080
12120 GOSUB12200:IFERTHEN12050
12130 IFRETHENPRINT"■MISSING LINE":GOTO12050
12140 EX$(NL)=MID$(I$,9):GOTO12080
12200 RE=FA:ER=FA:SK$=MID$(I$,5,4):IFSK$="0000"THENRE=TR:RETURN
12210 O$="DNS"+SK$:GOSUB600:IFLEFT$(I$,4)<>"DNST"THENPRINT"NET ERROR":ER=TR
12220 RETURN
12400 REM NT SV
12405 PRINT"■■NETSAVE":GOSUB12800:IFRE$=ES$THENRETURN
12410 PRINT:PRINT"NAME OF STRATEGY: ";:GOSUB15000:IFRE$=ES$THENRETURN
12420 D1$=B$:PRINT:PRINT"YOUR NAME: ";:GOSUB6:IFRE$=ES$THENRETURN
12430 NM$=B$:GOSUB14400
12440 O$="DNA"+O$+B$+D1$:GOSUB600
12450 IFLEFT$(I$,4)<>"DNAT"THENPRINTD1$" IN USE":GOTO12410
12455 SK$=MID$(I$,5):FORW=0TONL-1
```

```
12460 O$="DNL"+SK$+CO$(W):GOSUB600
12470 IFW<3THEN12500
12480 O$="DNL"+SK$+EX$(W):GOSUB600
12500 NEXT:PRINT"■"NM$"SAVED":GOSUB14200:RETURN
12600 REM NTNMS
12602 PRINT"■■NETNAMES":GOSUB12800:IFRE$=ES$THENRETURN
12610 PRINT: PRINT"BEGINNING WITH: ";:LS=16:L1$=" ":L2$=CHR$(255):B$=""
12612 GOSUB8400:SK$=B$:PRINT
12615 IFRE$=ES$THENRETURN
12620 O$="DNN000"+SK$
12630 GOSUB600:IFMID$(I$,4,1)<>"T"THEN12660
12640 PRINTMID$(I$,8):GETA$:IFA$=ES$THENGOTO12660
12650 O$="DNN"+MID$(I$,5,3)+SK$:GOTO12630
12660 GOSUB14200
12670 RETURN
12800 PRINT:PRINT"HAVE YOU DIALLED THE NETWORK? ";
12820 LS=1:L1$="N":L2$="Y":GOSUB6:IFB$="Y"ORRE$=ES$THENRETURN
12822 PRINT:PRINT:PRINT"DO YOU HAVE A MODEM? ";:GOSUB6
12824 IFRE$=ES$ORB$="N"THENRE$=ES$:RETURN
12830 PRINT:PRINT"PLEASE DIAL 469-2125"
12840 O$="NIM HELLO":GOSUB600:PRINTI$:RETURN
13000 REMQUIT
13010 PRINT:PRINT"■GOOD-BYE THEN":POKE40,1:POKE41,4:END
13200 REM ERROR AT BOT
13210 GOSUB13400:PRINT"■"ER$;:W=3:GOSUB13600:GOSUB13400:RETURN
13400 REM CLR BOT
13410 X=0:Y=22:GOSUB800:PRINTL$:PRINTL$;:GOSUB800:RETURN
13600 REM DLY W SECS
13610 T=TI
13620 IFTI<T+W*60THEN13620
13630 RETURN
13800 REM CMMT AT BOT
13810 X=0:Y=24:GOSUB800:PRINTL$;:GOSUB800
13820 PRINT"SHIFT ■&■ FOR MENU - SHIFT ■@■ TO DELETE";:RETURN
14000 REM-TITLE PAGE
14010 PRINT"■":POKE59468,14
14020 PRINTTAB(15)"■■/◥◤-♠┬♠┘■■
14030 PRINTTAB(6)"♠ PART OF THE ♠|_♠| ¬| | ┌NIT■
14040 PRINT" BY THE ◤ATH ┌ETWORK ─URRICULUM ┬ROJECT■
14050 PRINTTAB(18)"♠_♠ ┌■":PRINTTAB(6)"FOR 16┘ ┬| WITH |♠♠◥- 4.0■
14060 GOSUB18800
14180 X=0:Y=23:GOSUB14200
14190 PRINT"■":POKE59468,12:RETURN
14200 REM PRS RTN
14210 PRINT:PRINT"TO GO ON PRESS ■RETURN■";:LS=0:GOSUB6:RETURN
14400 REM FRMT O$
14410 O$=MID$(STR$(LEN(NM$)),2):IFLEN(O$)<2THENO$="0"+O$
14420 RETURN
14600 REM RDY TO PLAY
14605 POKE59468,12
14610 PRINT"■■■■■";TAB(12);"I'M READY TO":PRINTTAB(9)"■PLAY NIM WITH YOU.
14620 PRINTTAB(8)"■■■MAY I CHOOSE WHO GOES":PRINTTAB(12)"FIRST? (■Y■ OR ■N■)";
14640 LS=1:L1$="N":L2$="Y":GOSUB6:IFB$="Y"THENFI=1:RETURN
14650 IFB$<>"N"THEN14600
14652 PRINT"■■■■■■■■■■"TAB(7)"IN THE NEXT GAME WE WILL
14653 PRINTTAB(7)"START WITH"BE"MATCHES AND
14656 PRINTTAB(7)"THE MAX TO TAKE WILL BE"MA
14660 PRINTTAB(4);"■■■DO YOU WANT TO GO FIRST? (■Y■ OR ■N■) ";
14670 LS=1:L1$="N":L2$="Y":GOSUB6
14680 IFB$="Y"THENFI=3:RETURN
```

```
14690 IFB$<>"N"THEN14652
14760 FI=2:RETURN
14800 IFERTHEN14825
14805 PRINT"■■■■■■■■"
14810 IFMWTHENPRINT"■I WIN!■":GOTO14825
14820 PRINT"■CONGRATULATIONS!":PRINT"■YOU WIN!■"
14825 GOSUB14200
14830 RETURN
15000 REM GET FLNM
15010 LS=16:L1$="  ":L2$=CHR$(255):GOSUB6:PRINT:RETURN
18000 REMPLAY
18010 NU=VAL(CO$(0)):IFCO$(0)="START"THENNU=FNR(8)+12
18020 BE=NU:MA=VAL(CO$(1)):IFCO$(1)="MAX"THENMA=FNR(4)+2
18030 GOSUB14600:PRINT"■":GOSUB8800:LI=0:GOSUB19200
18040 OU=TR:IFFI=1THENFI=3:I$=CO$(2):GOSUB3000:I$=0$:GOSUB7000:IFOU=TRTHENFI=2
18042 IFOU<>FAANDOU<>TRTHENGOSUB10850:GOTO18080
18045 IFFI=3THEN18060
18050 GOSUB9400:IFERTHEN18080
18055 GOSUB9000:IFNU=0THENMW=TR:GOTO18080
18057 GOTO18070
18060 GOSUB9200:IFRE$=ES$THENRETURN
18065 GOSUB9000:IFNU=0THENMW=FA:GOTO18080
18070 FI=-2*(FI=3)-3*(FI=2):GOTO18045
18080 GOSUB14800
18090 RETURN
18600 REM RD KYS
18605 READKE$(NK):IF KE$(NK)<>"E"THENNK=NK+1:GOTO18605
18610 RETURN
18800 REMINIT
18802 BS=1048:SQ=BS+15:RB=BS+17:XB=BS+18:TX=BS+9:RX=BS+6:RF=1:SD=BS+3
18805 AL=-1:NE=0:TR=-1:FA=0:MK=32:MS=20:OV=16:NK=0:OF=65:ML=14:TB=16
18810 DIMSK$(MS),SK(MS),KE$(MK),P2%(OV-2),P3%(OV-2),P4%(OV-2)
18815 R2=NK:GOSUB18600:R0=NK:GOSUB18600:R1=NK:GOSUB18600
18820 I$="1":GOSUB3000:I$=0$:GOSUB7000
18825 MA$="■■■■■■■■■●■■■■■ ■■ ■■ ■■ ■■ ■"
18830 OPEN5,5
18835 D$="■■■■■■■■■■■■■■■■■■■■■■■■■■"
18840 BU$="■■ ■■■■  ■■■■■  ■■■■■  ■■■■■■■■■■■■■■■■■■■
```

```
 19100 PRINT"     F. EDIT MY STRATEGY
 19110 PRINT"     G. SAVE MY STRATEGY ON NETWORK
 19120 PRINT:PRINT"YOUR CHOICE: ";
 19130 L1$="A":L2$="G":LS=1:IFNL<1THENL2$="D"
 19140 GOSUB6
 19150 ONASC(B$)-64GOSUB9600,12000,12600,13000,18000,9800,12400
 19160 GOTO19020
 19200 IFLI>0THEN 19240
 19210 PRINT"START WITH:  "BE:PRINT"MAX TO BURN: "MA
 19220 PRINT"TAB(22)"WHO   BURNT LEFT
 19230 FOR N=1TO11:PRINTTAB(22);"|      |     |     |":NEXT:LI=1:RETURN
 19240 IFLI=1THENZ1$=PL$
 19250 PRINT";LEFT$(D$,LI);TAB(23);PL$;TAB(29);TU;TAB(34);NU-TU
 19260 LI=LI+1:RETURN
READY.
```

NIMRATER 2.0

```
READY.

 1 REM WRITTEN BY:  JERRY LANE.
 2 REM MATH NETWORK CURRICULUM PROJECT, SFSU, COPYRIGHT, 1981
 3 REM VERSION 2.0
 10 REM *** DECLARATIONS ***
 20 MATCH$="■■■■■■■■■●■■■■■■■■■
```

```
1315 GOTO 1420
1320 HEAD$=A$: GOTO 1350
1330 HEAD$=B$: GOTO 1350
1340 HEAD$=C$: GOTO 1350
1350 PRINT "■";
1355 PRINT LEFT$(D$,4);
1360 PRINT TAB(9);H1$
1370 PRINT TAB(9);H2$
1380 PRINT TAB(9);H3$
1390 PRINT TAB(12);HEAD$
1400 PRINT TAB(9);H4$
1410 PRINT TAB(9);H1$+"■": PRINT
1415 RETURN
1420 PRINT TAB(8);"TO EARN THIS RATING YOU"
1430 PRINT TAB(8);"MUST WIN THREE GAMES IN"
1440 PRINT TAB(8);"A ROW.  TO GO ON PRESS"
1450 PRINT TAB(8); "■RETURN■ ";
1460 LNTH=0: GOSUB 13000
1470 ON ASC(CAT$)-64 GOTO 1500,1650,1800
1500 REM*** NIM-STAR INSTRUCTIONS ***
1510 REM *** GAME PARAMETER SETUP ***
1520 PRINT"■";: GOSUB 1350
1530 PRINT TAB(8);"* WE START WITH 12 MATCHES.":PRINT
1540 PRINT TAB(8);"* WE CAN BURN 1 , 2 OR 3"
1550 PRINT TAB(10);"MATCHES ON A TURN.":PRINT
1560 PRINT TAB(8);"* YOU MUST BURN THE LAST"
1570 PRINT TAB(10);"MATCH TO WIN THE GAME"
1580 PRINT:PRINTTAB(8)"TO CHOOSE ANOTHER RATING"
1590 PRINT TAB(8);"PUSH ■SHIFT■ AND ■@■ TOGETHER."
1600 PRINT TAB(8);"TO CONTINUE PRESS ■RETURN■ ";
1610 LNTH=7:GOSUB 13000
1620 IF NOT(R$="" OR R$="—") GOTO 1500
1630 IF R$="—" GOTO 1210
1640 NUM=12: MAX=3: GOTO 2000
1650 REM *NIM - SUPER STAR INSTRUCTIONS
1660 PRINT"■";: GOSUB 1350
1670 PRINT TAB(8);"* WE START WITH BETWEEN"
1680 PRINT TAB(10);"12 AND 20 MATCHES."
1690 PRINT:PRINT TAB(8);"* WE CAN BURN 1 ,2 OR 3"
1700 PRINT TAB(10);"ON A TURN."
1710 PRINT:PRINT TAB(8);"* YOU MUST BURN THE LAST"
1720 PRINT TAB(10);"MATCH TO WIN THE GAME."
1730 PRINT:PRINTTAB(8);"TO CHOOSE ANOTHER RATING"
1740 PRINT TAB(8);"PRESS ■SHIFT■ AND ■@■ TOGETHER."
1750 PRINT TAB(8);"TO CONTINUE PRESS ■RETURN■ ";
1760 LNTH=1:GOSUB 13000
1770 IFNOT(R$="" OR R$="—") GOTO 1660
1780 IF R$="—" GOTO 1210
1790 NUM=INT(RND(1)*8+13):MAX=3:GOTO 2000
1800 REM * NIM - MASTER INSTRUCTIONS *
1810 PRINT "■";: GOSUB 1350
1820 PRINT TAB(8);"* WE START WITH BETWEEN"
1830 PRINT TAB(10);"12 AND 20 MATCHES."
1840 PRINT:PRINT TAB(8);"* EVERY GAME I'LL SAY HOW MANY"
1850 PRINT TAB(10);"MATCHES WE CAN BURN ON A TURN."
1860 PRINT:PRINT TAB(8);"* YOU MUST BURN THE LAST"
1870 PRINT TAB(10);"MATCH TO WIN THE GAME."
1880 PRINT:PRINT TAB(8);"TO CHOOSE ANOTHER RATING"
1890 PRINT TAB(8);"PRESS ■SHIFT■ AND ■@■ TOGETHER."
1900 PRINT TAB(8);"TO CONTINUE PRESS ■RETURN■ ";
```

```
1910 LNTH=1:GOSUB 13000
1920 IFNOT(R$="" OR R$="-") GOTO 1660
1930 IF R$="-" GOTO 1210
1940 NUM=INT(RND(1)*8+13)
1950 MAX=INT(RND(1)*5+2)
1960 IF MAX=3 GOTO1950
2000 REM **** THE GAME ****
2005 PRINT "■":GOSUB2020:TEMP=NUM
2010 PRINT"■";:GOTO2085
2020 PRINT "■■";HEAD$;SPC(18-LEN(HEAD$));"■ ■NAME      BURNT LEFT■ "
2030 FOR N = 1 TO 11
2040 PRINT TAB(18);" ▌          ▌     ▌      ▌":NEXT
2050 PRINT "■■BEGAN WITH: ";NUM
2060 PRINT "MAX TO BURN: ";MAX
2070 PRINT "WINS IN A ROW:";STR$(SW)
2080 RETURN
2085 GOSUB 10000
2087 GOSUB 14000
2090 PRINT"DO YOU WANT TO GO"
2100 PRINT "FIRST OR SECOND?"
2110 PRINT "(■F■ OR ■S■) THEN"
2120 PRINT "■RETURN■? ";
2130 LNTH=1:GOSUB 13000
2140 IF NOT(R$="F" OR R$="S")GOTO 2087
2150 GOSUB 14000
2155 FIRST$=R$
2160 IF R$="S" GOTO 2300
2170 REM *** PLAYER MOVE ***
2180 WHO$=NAME$
2190 PRINT "HOW MANY WOULD"
2200 PRINT "YOU LIKE TO"
2210 PRINT "BURN (1 TO";MAX;"▌▌)? ";
2220 LNTH=1:GOSUB13000
2225 VR=VAL(R$)
2230 IF NOT(VR>0 AND VR<=MAX AND VR<=NUM) THEN GOSUB 14000:GOTO 2190
2240 TURN=VAL(R$):GOSUB 12000
2250 TABLE(LINE)=TURN
2260 IF NUM=0 GOTO 2500
2270 GOSUB 15000
2300 REM *** COMPUTER MOVE ***
2310 TURN=NUM-INT(NUM/(MAX+1))*(MAX+1)
2313 IF TURN=0 THEN TURN=INT(RND(0)*(MAX+1)):GOTO  2313
2315 TABLE(LINE)=TURN
2320 WHO$="I": GOSUB 14000
2330 PRINT "I WILL BURN";TURN;"▌▌."
2340 FOR W=1 TO 500: NEXT W
2350 GOSUB 12000
2360 GOSUB 14000
2370 IF NUM=0 GOTO 2500
2380 GOSUB 15000: GOSUB 14000
2390 GOTO 2170
2500 IF WHO$=NAME$ THEN SW=SW+1
2505 IF SW=3 THEN GOTO 2650
2507 IF WHO$="I" THEN SW=0
2510 GOSUB 16000
2515 LINE=1
2520 GOSUB 14000:PRINT "WELL, LOOKS LIKE "
2530 PRINT WHO$;" WON THIS"
2531 PRINT "ONE.  CARE TO PLAY"
2533 PRINT "AGAIN (■Y■ OR ■N■ THEN"
```

```
2535 PRINT "■RETURN■)? ";
2536 LNTH=1:GOSUB13000
2537 IF NOT(R$="Y" OR R$="N")THEN 2520
2540 IF R$="N" THEN 2580
2560 ON ASC(CAT$)-64 GOTO 1640,1790,1940
2580 IF NAME$="YOU" THEN NAME$=""
2585 PRINT "■WELL UNFORTUNATELY ";NAME$;" YOU DID"
2590 PRINT "NOT WIN THREE GAMES IN A ROW WHICH"
2600 PRINT "DOES NOT GIVE YOU THE COVETED HONOR OF"
2610 PRINT "BEING ABLE TO CALL YOURSELF A :"
2620 PRINT "■■■■";:GOSUB1355
2630 PRINT TAB(9);"BETTER LUCK NEXT TIME."
2640 END
2650 PRINT"■";
2660 PRINT "CONGRATULATIONS ";NAME$;" YOU ARE NOW A:"
2690 PRINT"■":GOSUB 1355
2700 PRINT TAB(7);"***THANKS FOR PLAYING***"
2710 PRINT "■■■WOULD YOU LIKE TO SEE THE TABLE FROM"
2720 PRINT "THE LAST GAME? (■Y■ OR ■N■ THEN ■RETURN■)? ";
2740 LNTH=1:GOSUB 13000
2750 IF R$ ="Y" THEN PRINT"■";: GOSUB 16000
2760 PRINT"■■■■■■■GOOD-BYE FROM NIMRATER":END
10000 REM *** MATCH GRAPHICS ***
10010 PRINT"■";:PRINT"■";
10020 PRINT LEFT$(D$,23);
10030 FOR N = 1 TO NUM
10040 PRINT MATCH$;
10050 PRINT"■■■";
10060 N$=STR$(INT(N/10)):N$=N$+"■"
10070 IF INT(N/10)=0 THEN N$=" "
10080 PRINT "■"+N$;
10090 PRINT "■■";:PRINT N-10*(INT(N/10));
10100 NEXT N
10110 RETURN
12000 REM *** BURNING GRAPHICS ***
12010 PRINT"■";:PRINT"■";
12020 PRINT LEFT$(D$,12);:PRINTTAB(NUM*2-2);
12030 FOR N = 1 TO TURN
12035 IF NUM=1 GOTO 12120
12040 FOR T = 1 TO 5
12050 PRINT F1$;
12060 FOR W = 1 TO 10: NEXT W
12070 PRINT F2$;
12075 FOR W = 1 TO 10: NEXT W
12080 NEXT T
12090 PRINT CLEAR$;: PRINT BURN$;: NUM = NUM-1
12100 NEXT N
12110 RETURN
12120 PRINT "■■";
12130 PRINT LEFT$(L$,19);:PRINT LEFT$(D$,17);
12140 PRINT MATCH$;:PRINT "■";
12150 FOR D = 6 TO 12
12160 PRINT LEFT$(D$,D);:PRINT LEFT$(L$,19);
12170 FOR T = 1 TO 5
12180 PRINT F1$;
12190 FOR W = 1 TO 10:NEXT W
12200 PRINT F2$;
12210 FOR W = 1 TO 10:NEXT W
12220 NEXT T
12230 PRINT CLEAR$+"■";
```

```
 12240 NEXT D
 12250 PRINT LEFT$(D$,D+1);:PRINT LEFT$(L$,20);
 12260 PRINT "■■■POOF!■■";:NUM=NUM-1
 12270 FOR W = 1 TO 500: NEXT W
 12280 PRINT "□";:RETURN
 13000 REM *** INPUT ROUTINE ***
 13005 POKE 158,0
 13010 W=TIME: R$="":R1$=""
 13020 IF TIME<W+30 THEN PRINT"▒■";:GOTO 13050
 13030 IF TIME<W+60 THEN PRINT" ■";:GOTO 13050
 13040 W = TIME
 13050 GET R1$
 13053 IF R1$<>"—" THEN GOTO 13060
 13055 PRINT"ESCAPE"
 13056 FOR W = 1TO200: NEXT W:GOTO 1210
 13060 IF R1$="" GOTO 13020
 13070 CODE=ASC(R1$)
 13080 IF CODE=13 THEN PRINT" ■";:RETURN
 13100 IF R$<>"" AND CODE=20 THEN PRINT" ■■ ■";: R$=LEFT$(R$,LEN(R$)-1)
 13130 IF CODE<32 OR (CODE>127 AND CODE<151) THEN13020
 13135 IF LEN(R$)=LNTH GOTO13020
 13140 PRINT R1$;:R$=R$+R1$:GOTO 13020
 14000 REM *** CLEAN I/O AREA ***
 14010 PRINT "□";:PRINT"■■■■■■■";
 14020 FOR N = 1 TO 5
 14030 PRINT LEFT$(L$,18)
 14040 NEXT N
 14050 PRINT "■■■■■■■";
 14060 RETURN
 15000 REM *** TABLE MAINTENENCE ***
 15010 PRINT "□";:PRINT "■";
 15020 PRINT LEFT$(D$,LINE);:LINE=LINE+1
 15023 HOLD$=NAME$
 15025 IF WHO$="I" THEN HOLD$="ME"
 15030 PRINT TAB(19);HOLD$;"□"
 15040 PRINT TAB(29);TURN;"□"
 15050 PRINT TAB(33);NUM
 15060 PRINT "■■■■";TAB(14);STR$(SW)
 15070 RETURN
 16000 REM *** RE-BUILD THE TABLE ***
 16002 KEEP$=WHO$
 16003 NUM=TEMP:TEMP=LINE:LINE=1
 16004 WHO$="I"
 16005 IF FIRST$="F"THEN WHO$=NAME$
 16010 GOSUB 2020
 16020 FOR N = 1 TO TEMP
 16030 TURN=TABLE(N)
 16035 NUM=NUM-TURN
 16040 GOSUB 15000
 16050 IF WHO$=NAME$ THEN WHO$="I":GOTO  16070
 16060 IF WHO$="I" THEN WHO$=NAME$
 16070 NEXT N
 16080 WHO$=KEEP$:RETURN
READY.
```

CALENDAR 2.0

```
READY.

 10 REM CALENDAR GAME BY LYNNE ALPER & BILL FINZER
 12 REM A PART OF THE MATH NETWORK CURRICULUM PROJECT AT
 15 REM SAN FRANCISCO STATE UNIVERSITY
 20 REM COPYRIGHT, JANUARY, 1981
 22 REM VERSION 2.0
 1000 REM----MAIN PROGRAM----
 1020 GOSUB 1400:REM-TITLE AND INIT-
 1030 GOSUB2000:REM----FIRST PAGE----
 1040 IF B$="N"THENPRINT"■":GOTO1060
 1050 GOSUB3000:REM----INSTRUCTIONS----
 1060 GOSUB 4000 CHOOSE FIRST
 1070 IF MACH THEN GOSUB 4200
 1080 IF NOT MACH THEN GOSUB 9200
 1090 IF CM=12 AND CD=31 THEN WIN=TR:GOSUB 5000 A WINNER!
 1100 IF NOT WIN THEN MACH=NOT MACH:GOTO 1070
 1110 PRINT:PRINT"DO YOU WANT TO PLAY AGAIN? ";:GOSUB10400 Y OR N
 1120 IF B$="Y" THEN CM=0:WIN=FA:GOTO1060
 1130 PRINT:PRINT"■WELL, THANKS FOR PLAYING.
 1140 END
 1200 REM----INITIALIZE SUBROUTINE-----
 1210 AC$="▒":ES$="—":RT$=CHR$(13):LS=38:L1$=" ":L2$=CHR$(255)
 1220 D$="■■■
```

```
1495 PRINT"|     |     |     |     |     |     |     |
1500 PRINT"| 27  | 28  | 29  | 30  | 31  |     |     |
1505 PRINT"└─────┴─────┴─────┴─────┴─────┴─────┴─────┘
1507 GOSUB1200
1510 PRINT:PRINTTAB(6)"PRESS RETURN TO GO ON ";:LS=0:GOSUB8400
1520 RETURN
2000 REM----FIRST PAGE SUBROUTINE----
2005 PRINT"":PRINT:PRINT:PRINT"      WELCOME TO THE CALENDAR GAME.
2017 PRINT:PRINT:PRINT:PRINT:PRINT:PRINT
2020 PRINT"      ┌──────────────────────────────┐
2022 PRINT"      │                              │
2024 PRINT"      │ TARGET DATE : DECEMBER 31    │
2026 PRINT"      │                              │
2028 PRINT"      └──────────────────────────────┘
2040 PRINT"     DO YOU WANT INSTRUCTIONS (Y OR N)? ";
2050 GOSUB 10400
2060 RETURN
3000 REM----INSTRUCTIONS SUBROUTINE----
3005 PRINT"":POKE59468,14
3007 PRINTTAB(5)"INSTRUCTIONS FOR CALENDAR GAME
3010 PRINT"YOU ARE PLAYING AGAINST ME. WE TAKE"
3015 PRINT"TURNS CHOOSING DATES CLOSER AND"
3020 PRINT"CLOSER TO DECEMBER 31. WHOEVER CAN"
3025 PRINT  "CHOOSE DECEMBER 31 WINS.":PRINT
3030 PRINT"ONCE THE FIRST DATE IS SET, THE NEXT"
3035 PRINT"PLAYER MUST PICK A LATER DATE WITH
3040 PRINT"EITHER THE SAME MONTH OR THE SAME
3045 PRINT"DAY (NUMBER) AS THE PREVIOUS ONE.":PRINT
3047 PRINT"FOR EXAMPLE, IF I CHOOSE FEBRUARY 3,
3050 PRINT"YOU MAY CHOOSE ANY LATER DATE IN
3055 PRINT"FEBRUARY OR ANY LATER MONTH WITH DAY 3
3060 PRINT"(MARCH 3, APRIL 3, ETC.).":PRINT
3070 PRINT:PRINT:PRINT"      PRESS RETURN TO CONTINUE ";
3080 LS=0:GOSUB8400:POKE59468,12:RETURN
4000 REM-----CHOOSE FIRST----
4010 PRINT"OKOK, LET'S START!
4020 PRINT"DO YOU WANT TO GO FIRST? ";
4030 GOSUB 10400
4040 IF B$="Y" THEN MACH=FA
4050 IF B$="N" THEN MACH=TR
4060 RETURN
4200 REM-----MACHINE'S TURN-----
4210 IF CM=0 THEN GOSUB 4400:GOTO 4350 FIRST TIME CHOOSE AT RANDOM
4220 IF CD=BD(CM) THEN GOSUB 4600:GOTO4350 FACED WITH NO GOOD MOVE
4230 IF CD>19+CM THEN GOSUB 4800:GOTO4350 CHANGE MONTH
4240 REM LEAVE MONTH THE SAME
4250 CD = BD(CM)
4350 PRINTBL$"
4360 PRINTTAB(16)"I CHOOSE "MNTH$(CM)" "CD
4390 RETURN
4400 REM---MACHINE CHOOSES AT RANDOM--
4410 CM = INT(RND(1)*9+1)
4420 CD = BD (CM)
4430 RETURN
4600 REM---MACHINE, NO GOOD MOVE--
4610 FLAG=RND(1)>.5
4620 IF FLAG THEN 4700
4630 REM CHANGE MONTH
4640 IF CM=12 THEN 4700 NOPE, CAN'T
4650 CM=CM+1+INT(RND(1)*(12-CM))
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4660 GOTO4790
4700 REM CHANGE DAY
4710 IF CD=ND(CM) THEN 4630 NOPE, CAN'T
4720 CD = CD+1+INT(RND(1)*(ND(CM)-CD))
4790 RETURN
4800 REM  CHANGE MONTH
4810 CM = CD - 19
4820 RETURN
5000 REM----A WINNER!-----
5005 PRINT
5010 IF MACH THEN PRINT"■LOOKS LIKE I WIN THIS TIME!
5020 IF NOT MAACH THEN PRINT"■YOU BEAT ME FAIR AND SQUARE!!
5030 RETURN
7000 REM----PLAYER'S TURN SUBROUTINE----
7005 PRINT:INPUT"WHAT MONTH DO YOU CHOOSE";N$
7010 FORR=1TO12:IFM$(R)=LEFT$(N$,3)THEN7030
7020 NEXT
7025 PRINT:PRINTN$" IS NOT A VALID MONTH":GOTO7005
7030 PRINT:INPUT"WHAT DAY DO YOU CHOOSE ";DA$
7031 IFVAL(DA$)=DANDLEFT$(P$(I),3)=LEFT$(N$,3)THENGOTO7070
7032 GOSUB10000
7033 IFBADDAY=1THEN7005
7034 D=VAL(DA$):RIGHT=VAL(RIGHT$(P$(I),2))
7035 IFLEFT$(P$(I),3)<>LEFT$(N$,3)THEN7060
7040 IFRIGHT> DTHEN7070
7045 RETURN
7060 IF RIGHT<>D THEN7070
7062 IFR<ITHEN7070
7063 RETURN
7070 PRINT:PRINTN$" "DA$" IS NOT A VALID DATE":GOTO7005
7100 RETURN
7200 REM----PET'S TURN SUBROUTINE----
7210 FORI=1TO12
7220 IFLEFT$(N$,3)=M$(I)THEN7240
7230 NEXT
7240 RIGHT=VAL(RIGHT$(P$(I),2)):D=VAL(DA$)
7250 IFD <RIGHT           THENPRINT:PRINT"■I CHOOSE "P$(I):RETURN
7260 IFD=RIGHTTHEN7300
7270 FORZ=1TO12
7280 IFDA$=RIGHT$(P$(Z),2)THEN7320
7290 NEXT
7300 PRINT:PRINT"■I CHOOSE "LEFT$(P$(I+1),9)""DA$
7310 I=I+1:RETURN
7320 PRINT:PRINT"■I CHOOSE "P$(Z)
7330 I=Z
7340 RETURN
8000 REM-----GET CHAR------
8010 T=TI:RE$=RT$
8020 IFTI<T+30THENPRINT"▒▒";:GOTO8050
8030 IFTI<T+60THENPRINT" ▒";:GOTO8050
8040 T=TI
8050 GETA$:IFA$=""THEN8020
8060 IFA$=AC$THENRE$=AC$
8070 IFA$=ES$THENRE$=ES$
8080 PRINT" ▒";
8190 RETURN
8200 REM-----GET STRING------
8210 GOSUB8000:A=ASC(A$)
8220 IFB$=""ANDA=20THEN8210
8230 IFB$=""ANDA=13THENRETURN
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8240 IFA=13THENPRINT:RETURN
8250 IFRE$=AC$ORRE$=ES$THENPRINT:RETURN
8260 IFA=20ANDLEN(B$)<2THENPRINTA$;:B$="":GOTO8210
8270 IFA=20THENPRINTA$;:B$=LEFT$(B$,LEN(B$)-1):GOTO8210
8280 IFA<32OR(A)127ANDA<161)THEN8210
8290 IFLEN(B$)>=LSTHEN8210
8295 IFB$+A$<L1$ORB$+A$>L2$THEN8210
8300 PRINTA$;:B$=B$+A$
8310 IFA$=CHR$(34)THENPRINTA$"■ "CHR$(20);
8320 GOTO8210
8400 REM-----GET NON-EMPTY STRING------
8410 B$="":POKE158,0
8415 GOSUB8200:IFLS=0THENRETURN
8420 IFRE$=AC$ORRE$=ES$ORB$<>""THENRETURN
8430 GOTO8415
9000 REM----PLAY AGAIN? SUBROUTINE----
9002 INPUT"DO YOU WANT TO PLAY AGAIN";Y$
9005 IF LEFT$(Y$,1)="N"THENEND
9010 IFLEFT$(Y$,1)="Y"THEN1030
9015 PRINT"PLEASE ANSWER YES OR NO":GOTO9000
9020 RETURN
9200 REM----GET DATE-----
9205 PRINTBL$"□
9210 PRINT"WHAT DATE DO YOU CHOOSE? ■";
9220 L1$="A":L2$="Z":LS=13:GOSUB8400
9225 DT$=B$
9230 GOSUB 9400 FIND MONTH
9240 IF ER THEN 9205
9250 GOSUB 9600 FIND DAY
9260 IF ER THEN9205
9270 GOSUB 9800 CHECK LEGALITY
9280 IF ER THEN 9205
9290 RETURN
9400 REM----FIND MONTH-----
9410 ER=TR:GOSUB10000
9420 IF NOT RE THEN RETURN
9430 MNTH$=LEFT$(TK$,3)
9440 FOR M=1TO12
9450 IF MNTH$=MABR$(M) THEN MNTH=M:M=12:ER=FA
9460 NEXT M
9470 IF NOT ER THENRETURN
9480 ER$="I DON'T RECOGNIZE "+TK$:GOSUB10200
9590 RETURN
9600 REM----FIND DAY-----
9605 ER=FA
9610 DAY=VAL(B$):REM REMAINDER OF B$
9620 IFDAY=0 THEN ER$="PLEASE TELL ME THE DAY, TOO":ER=TR
9630 IF DAY>ND(MN) THEN ER$=MN$(MN)+" HAS ONLY"+STR$(ND(MN))+" DAYS.":ER=TR
9640 IF ER THEN GOSUB 10200
9650 RETURN
9800 REM----CHECK LEGALITY---
9810 ER=TR
9812 IFCM=0AND(MN=12ANDDA=31)THENER$="CAN'T START WITH DECEMBER 31":GOTO9860
9814 IF CM=0 THEN 9900
9820 IF MNTH=CM AND DAY>CD THEN 9900
9830 IF MNTH>CM AND DAY=CD THEN 9900
9840 IF MNTH*100+DAY <= CM*100+CD THEN ER$="MUST CHOOSE LATER DATE":GOTO9860
9850 IF MNTH<>CM AND DAY<>CD THEN ER$="CAN'T CHANGE BOTH MONTH AND DAY"
9860 GOSUB10200:RETURN
9900 CM=MNTH:CD=DAY:ER=FA
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 9990 RETURN
 10000 REM----GET TK$ FROM B$----
 10010 TK$="":RE=FA
 10020 IFLEN(B$)=0THENRETURN
 10030 IFLEFT$(B$,1)=" "THENB$=MID$(B$,2):GOTO10020
 10050 C$=LEFT$(B$,1)
 10060 IF C$=" " OR (C$)="0" AND C$<="9") OR C$="" THEN RE=TR:RETURN
 10070 B$=MID$(B$,2):TK$=TK$+C$
 10080 GOTO10050
 10200 REM------HANDLE ERROR----
 10205 PRINTBL$"
 10210 PRINT"  "ER$"
 10220 RETURN
 10400 REM Y OR N
 10410 LS=1:L1$="N":L2$="Y"
 10420 GOSUB8400
 10430 IF B$<>"Y" AND B$<>"N" THEN PRINT"  Y  OR  N  PLEASE ";:GOTO 10420
 10440 RETURN
 20000 REM TEST CASE
 20005 CLR:PRINT"
 20010 GOSUB 1200
 20020 GOSUB 9200
 20030 GOTO20020
READY.
```